

A Practice-Based Approach to Examining Knowledge Management Repository Use.

A THESIS SUBMITTED FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

BY
JOHN NICHOLAS WALSH

SCHOOL OF INFORMATION SYSTEMS, COMPUTING AND MATHEMATICS
BRUNEL UNIVERSITY

MAY 2010

ABSTRACT

Though knowledge has become an increasingly important resource for modern businesses, it was not until the mid-1990's that the 'knowledge management' research stream emerged in the business and information systems literature. Initial research on how to manage knowledge came from an objectivist epistemology of knowledge that viewed it as something that was capable of captured, stored and transferred via information to increase organisational efficiency. This study is grounded in a more recent and alternative perspective that takes a practice based epistemology seeing knowledge as embedded in and inseparable from practice.

The practices of interest relate to how knowledge work is performed in environments where there is heavy reliance on information systems. Using an interpretive case study this research analyses the practices of a product support centre of a US multinational. Data was collected through semi-structured interviews and internal documentation, including access to the firms 'knowledge management' repository. Two central practices were examined: how product support engineers made sense of problems to develop fix procedures and how these were subsequently documented. Even within a work environment where client fixes were verifiable, suggesting an objectivist epistemology, this research found that the practice based perspective could be used to provide a different perspective and develop alternative and useful insights.

The study contributes to the practice based perspective on knowledge management by providing an analysis of context specific knowledge work practices by analysing how even in procedural repetitive work agency can be exhibited as actors enact practices. It also helps develop the application of Structuration Theory by aiding an understanding of how meanings, norms and resources are developed, drawn upon, conflict, and are changed as everyday work is accomplished. The study is of relevance by providing an understanding of informal knowledge work practices rather than their formal description.

ACKNOWLEDGEMENTS

To my Supervisor Dr. Laurence Brooks, for his advice and commitment over more years than he or I expected. Thank you for everything you have done for me.

To Dr. Fergal McGrath for disagreeing with everything I say on principle and for the long discussions and new ideas that helped shape my thinking over years.

To everyone I encountered in the AIB Centre for Information and Knowledge Management over the course of this thesis: Catherine, Eileen, Emer, Emma, Eoin, Frank, Ger, Helen, John L, John Mc, Liz, Marian, Paddy, Rebecca.

To my colleagues at the Kemmy Business School at the University of Limerick.

To my mother Helen without whose love and support I would never have had the chance to start this thesis.

To my wife Liz, without whose love and support I may never have finished this thesis.

DEDICATION

Daniel J. Walsh
1929-1989

Daniel R. Walsh
Born 12/5/2010

*"We see the brightness of a new page where everything yet can happen."
-- Rainer Maria Rilke, Book of Hours*

TABLE OF CONTENTS

ABSTRACT	II
ACKNOWLEDGEMENTS	III
DEDICATION	IV
TABLE OF CONTENTS	V
LIST OF TABLES	IX
LIST OF FIGURES	X
1 INTRODUCTION	1
1.1 OUTLINE OF THE KNOWLEDGE MANAGEMENT RESEARCH AREA	2
1.1.1 <i>THE TRADITIONAL KNOWLEDGE MANAGEMENT PERSPECTIVE</i>	2
1.1.2 <i>THE PRACTICE BASED PERSPECTIVE</i>	3
1.2 RESEARCH AIMS AND OBJECTIVES	5
1.2.1 <i>CONTEXTUAL SETTING</i>	6
1.3 RESEARCH METHODOLOGY	6
1.4 RESEARCH CONTRIBUTION	8
1.5 STRUCTURE OF THE THESIS	8
2 THE TRADITIONAL KNOWLEDGE MANAGEMENT PERSPECTIVE	10
2.1 KNOWLEDGE CATEGORIES	10
2.2 KNOWLEDGE LIFECYCLE MODELS	17
2.2.1 <i>PRE-CREATION</i>	19
2.2.2 <i>CREATION</i>	19
2.2.3 <i>CAPTURE</i>	20
2.2.4 <i>TRANSFER</i>	21
2.2.5 <i>APPLY</i>	26
2.2.6 <i>POST-APPLICATION</i>	27
2.3 CRITICISMS OF THE SUBJECT/OBJECT PERSPECTIVE	27
2.4 KNOWLEDGE WORKERS	29
2.4.1 <i>HOW KNOWLEDGE WORK IS DIFFERENT</i>	30
2.5 ATTRIBUTES OF KNOWLEDGE WORKERS	31
2.5.1 <i>KNOWLEDGE WORKER OR PROFESSIONAL?</i>	31
2.5.2 <i>COMPETENCIES</i>	33
2.5.3 <i>INTELLECTUAL ABILITY</i>	33
2.5.4 <i>CAPACITY TO ACT</i>	33
2.5.5 <i>SOCIAL</i>	34
2.5.6 <i>LEARNING</i>	35
2.5.7 <i>OTHER CATEGORIES</i>	35
2.5.8 <i>SELF IDENTITY</i>	35
2.5.9 <i>MOTIVATION</i>	35
2.6 CONCLUSION	37
3 THE PRACTICE BASED PERSPECTIVE OF KNOWLEDGE MANAGEMENT	38
3.1 PHENOMENA INVESTIGATED:	39
3.2 AGENCY	40
3.2.1 <i>KNOWLEDGABILITY OF ACTORS</i>	43
3.2.2 <i>WORK ATTRIBUTES</i>	45
3.2.3 <i>ACTORS KNOWLEDGABILITY BOUNDED BY CONTEXT SPECIFICITY</i>	46
3.2.4 <i>PERSPECTIVE MAKING AND TAKING</i>	47
3.2.5 <i>LEARNING</i>	52
3.3 STRUCTURE	53
3.3.1 <i>DUALITY OF STRUCTURE</i>	56
3.4 LINKING AGENCY AND STRUCTURE- MODALITIES OF STRUCTURATION	59
3.4.1 <i>RULES</i>	59

3.4.2	<i>STRUCTURE OF SIGNIFICATION</i>	61
3.4.3	<i>STRUCTURE OF LEGITIMATION</i>	63
3.4.4	<i>GENRE RULES</i>	64
3.4.5	<i>RESOURCES</i>	65
3.5	COMMUNICATIVE GENRES	66
3.5.1	<i>GENRE TYPES</i>	66
3.5.2	<i>GENRE NORMS</i>	67
3.5.3	<i>GENRE COMMUNICATIVE REPERTOIRES</i>	68
3.5.4	<i>GENRE STRUCTURES</i>	69
3.6	PRACTICES	69
3.6.1	<i>KNOWING AS SOCIALLY CONSTRUCTED PRACTICE</i>	71
3.6.2	<i>COORDINATION AND COLLABORATION</i>	77
3.6.3	<i>FEEDBACK</i>	81
3.6.4	<i>CHANGE</i>	81
3.6.5	<i>RECURRENT PRACTICES AND TIME</i>	85
3.6.6	<i>CONSTRAINT DUE TO ROUTINES</i>	86
3.6.7	<i>VIEW OF TECHNOLOGY:</i>	86
3.7	THE PRACTICE BASED VIEW AND KNOWLEDGE MANAGEMENT	87
3.8	CONCLUSION	88
4	METHODOLOGY	90
4.1	POSITIVISM	90
4.2	INTERPRETIVISM	91
4.2.1	<i>EVALUATION CRITERIA</i>	94
4.3	RESEARCH QUESTIONS	96
4.4	RESEARCH DESIGN- CASE STUDIES	97
4.4.1	<i>CASE SELECTION CRITERIA</i>	99
4.4.2	<i>ACCESS</i>	100
4.4.3	<i>UNIT OF ANALYSIS</i>	101
4.4.4	<i>DISADVANTAGES</i>	102
4.4.5	<i>SINGLE VS. MULTIPLE CASES</i>	103
4.4.6	<i>THE USE OF PRIOR LITERATURE</i>	104
4.4.7	<i>THE RESEARCHER</i>	105
4.4.8	<i>CASE DATABASE</i>	106
4.4.9	<i>DATA COLLECTION</i>	107
4.4.10	<i>SAMPLING</i>	110
4.5	DATA ANALYSIS	111
4.5.1	<i>INDUCTION</i>	111
4.5.2	<i>CODING</i>	113
4.6	CONCLUSION	117
5	CALL CENTRES AND THE CASE COMPANY	119
5.1	DESCRIPTION OF CALL CENTRES	119
5.2	ORGANISATIONAL STRUCTURE	122
5.2.1	<i>CALLS</i>	123
5.2.2	<i>METRICS</i>	124
5.2.3	<i>COACHING</i>	127
5.3	KNOWLEDGE WORK	128
5.3.1	<i>ANALYSING CASES</i>	128
5.3.2	<i>READING</i>	129
5.3.3	<i>DOCUMENTING SOLUTIONS</i>	129
5.3.4	<i>AGENCY</i>	130
5.3.5	<i>WORK PRACTICES</i>	131
5.3.6	<i>PARALLEL WORK</i>	131
5.3.7	<i>LEARNING</i>	132
5.3.8	<i>REPUTATION</i>	133
5.4	CONCLUSION	133

6	THE CASE ANALYSIS PRACTICE.....	135
6.1	PROBLEM DEFINITION.....	136
6.1.1	INITIAL INFORMATION.....	138
6.1.2	GENRES OF DOCUMENTS AVAILABLE AS INITIAL INFORMATION.....	140
6.1.3	KNOWLEDGABILITY OF PSE.....	143
6.1.4	CUSTOMER INTERACTION.....	146
6.1.5	INTERACTION MEDIA CHOICE.....	148
6.1.6	PROBLEM (RE)DEFINITIONS.....	149
6.1.7	FILTERING- CASES OUTSIDE BOUNDARY.....	151
6.2	SEARCH.....	153
6.2.1	SEARCH TYPES.....	155
6.2.2	CONTEXT SPECIFICITY OF SOLUTION.....	160
6.2.3	SCOPING SOLUTIONS.....	164
6.3	HELP SEEKING-HELP GIVING.....	167
6.3.1	NOVICE HELP-SEEKING.....	170
6.3.2	INTERACTION.....	172
6.3.3	THIRD PARTY INTERACTION.....	175
6.4	SOLUTION REUSE.....	177
6.4.1	DEFLECTION.....	179
6.4.2	LINKING SEARCHES.....	179
6.5	DEVELOPING A FIX.....	182
6.5.1	WHEN TO PROVIDE CONTEXT.....	183
6.5.2	TYPES OF FIX.....	183
6.5.3	IMPLEMENTING A FIX.....	185
6.6	ANNOTATING WORK IN PROGRESS.....	186
6.6.1	ISSUE COMMANDS.....	189
6.6.2	POST-FIX REFLECTION- NEED TO DOCUMENT.....	190
6.7	MAIN THEMES.....	191
6.7.1	SOLUTIONS GENRE.....	191
6.7.2	SOLUTION STRUCTURE.....	192
6.7.3	DEFINING WORK & NEGOTIATING IDENTITY.....	194
6.7.4	KNOWLEDGE WORK.....	195
6.7.5	AGENCY.....	196
6.7.6	MEANINGS.....	198
6.7.7	NORMS.....	199
6.7.8	NOVICE LIFECYCLE.....	200
6.7.9	INTERACTION.....	201
6.7.10	DEFINING WORK AND NEGOTIATING IDENTITY.....	202
6.8	CONCLUSION.....	203
7	THE SOLUTION DOCUMENTATION PRACTICE.....	207
7.1	REPOSITORY IMPLEMENTATION.....	208
7.2	REPOSITORY SOLUTIONS.....	216
7.2.1	DRAFT SOLUTIONS.....	218
7.2.2	SOLUTION ADMINISTRATION.....	219
7.2.3	METRICS.....	220
7.2.4	AVAILABLE TIME.....	222
7.2.5	DEFLECTION.....	223
7.3	WRITING FOR OTHERS.....	225
7.3.1	LANGUAGE.....	226
7.3.2	SLS FACILITY: KNOWLEDGE SEGMENTATION.....	228
7.3.3	RATIONALES.....	230
7.3.4	REPUTATION.....	232
7.3.5	PRODUCT SUPPORT EMPLOYEE TYPES.....	235
7.3.6	SOLUTION MODIFICATION.....	241
7.3.7	NON-REFERENTIAL MODIFICATIONS.....	242
7.3.8	SOCIAL CAPITAL.....	242
7.3.9	SPECIALIZATION.....	244
7.4	CONCLUSIONS- SOLUTION DOCUMENTATION PRACTICE.....	245
7.4.1	KNOWLEDGE REPOSITORY.....	245

7.4.2	<i>KNOWLEDGE WORK</i>	246
7.4.3	<i>ORGANISATIONAL PERSPECTIVE</i>	247
7.4.4	<i>MANAGEMENT</i>	248
7.4.5	<i>MONITORING OF OTHERS</i>	250
7.4.6	<i>AGENCY</i>	252
7.4.7	<i>MEANINGS</i>	253
7.4.8	<i>PERSPECTIVES</i>	254
7.4.9	<i>NORMS</i>	255
7.4.10	<i>PRACTICES</i>	256
7.4.11	<i>SOCIAL CAPITAL</i>	257
7.4.12	<i>CHANGE</i>	258
8	LIMITATIONS, CONCLUSIONS, AREAS FOR FUTURE RESEARCH AND RESEARCH CONTRIBUTION	259
8.1	LIMITATIONS.....	259
8.1.1	<i>THEORETICAL PERSPECTIVES</i>	259
8.1.2	<i>CASE CONTEXT</i>	260
8.1.3	<i>ACCESS TO COMPANY</i>	260
8.1.4	<i>RESEARCHER RELATED</i>	261
8.1.5	<i>RESEARCH METHODS</i>	262
8.1.6	<i>GENERALIZABILITY OF FINDINGS</i>	263
8.2	CONTRIBUTIONS TO STAKEHOLDERS.....	263
8.2.1	<i>KNOWLEDGE WORKERS</i>	263
8.2.2	<i>OPERATIONAL MANAGERS</i>	266
8.2.3	<i>MIDDLE MANAGERS</i>	267
8.2.4	<i>TOP MANAGERS/ORGANIZATIONAL PERSPECTIVE</i>	268
8.2.5	<i>KNOWLEDGE MANAGEMENT SYSTEM DEVELOPERS</i>	268
8.3	CONTRIBUTIONS.....	269
8.3.1	<i>STRUCTURATION THEORY/PRACTICE BASED PERSPECTIVE</i>	269
8.3.2	<i>KNOWLEDGE MANAGEMENT</i>	273
8.3.3	<i>CALL CENTRES</i>	274
8.4	AREAS FOR FUTURE RESEARCH.....	274
9	BIBLIOGRAPHY	277

LIST OF TABLES

Table 1: Knowledge Categories	12
Table 2: Stages in Knowledge Lifecycle Models	18
Table 3: Units of Analysis for Knowledge Transfer.....	23
Table 4 Interview Participants.....	108
Table 5: Sections of a Primus Solution.....	138
Table 6: Information Sources	141

LIST OF FIGURES

Figure 1: Knowledge Articulability	15
Figure 2: Knowledge Type and Level of Diffusion.....	22
Figure 3: Data Collection Process	109
Figure 4: The Case Analysis Process.....	135
Figure 5: Problem (Re)Definition.....	137
Figure 6: Error Codes.....	138
Figure 7: Knowledgability	146
Figure 8: Solution Outlines Information to be Gathered by Customer.....	148
Figure 9: Non-Event	151
Figure 10: Knowledge Domain Boundary Issue	153
Figure 11: Searching	153
Figure 12: Fix Procedure.....	156
Figure 13: Fix Alternatives from Solution	157
Figure 14: Fix Alternatives Diagram	158
Figure 15: Narrowing Down- Not Applicable	158
Figure 16: Wider Understanding	159
Figure 17: Perspectives in Solution	163
Figure 18: Alternative Problem Definitions	163
Figure 19: Changing Contexts.....	164
Figure 20: Multiple Environments.....	164
Figure 21: Widening Solution Contexts.....	165
Figure 22 References to Solutions	165
Figure 23: Solution references other Solutions	166
Figure 24: Solution Internally Referenced	166
Figure 25: Part of Fix uses existing Solution	166
Figure 26: Help Seeking & Help Giving	168
Figure 27: Solution Reuse	178
Figure 28: Linking Solutions.....	181
Figure 29: Providing a Rationale.....	183
Figure 30: 'Permanent' Fix Reference.....	184
Figure 31: Alternative Courses of Action	185
Figure 32: Developing a Fix.....	186
Figure 33: Annotating	189
Figure 34: Issue Command Dangers.....	190
Figure 35: Solution Documentation.....	207
Figure 36: System Usage at Implementation	209
Figure 37: Repository Implementation 1	211
Figure 38: Repository Implementation 2	216
Figure 39: Using Solutions to Aid Customer Learning	224
Figure 40: Reference to Customer Support Department.....	226
Figure 41: Warnings Contained in Solution.....	226
Figure 42: Definitions in Solutions.....	227
Figure 43: Providing Wider Understanding	230
Figure 44: Worker Types	238
Figure 45: Social Capital.....	243

1 INTRODUCTION

This thesis is located within the practice-based perspective of knowledge management research. Growing from a critique of the traditional view in the knowledge management literature the practice-based perspective conceptualises knowledge not as an entity that can be owned by an organization but takes an epistemological stance that sets the focus on knowledgability as exhibited through socially constructed practices.

This research examines involves a case study of the lowest and most structured level of a technical support call centre. The centre is heavily automated with an extensive knowledge management repository for workers to use. Only the most basic cases are to be resolved at this level with more complex cases being escalated to higher support levels. In this environment a number of key work practices were identified and are examined in detail. The research finds that rather than strictly following the organizational rules and procedures, even in so structured an environment workers exhibited agency. The way they actually carried out their work varied from mandated procedures. This divergence had positive and negative effects for both workers and Pi-Corp and resulted in a number of unintended consequences.

The next section begins by outlining the main research streams in the area of knowledge management. The more traditional view of knowledge within this literature is that it can exist as an object in an explicit format suitable for storage within knowledge management systems. Where knowledge has not been made explicit but exists in a tacit form then the role of knowledge workers (in whose heads this tacit knowledge resides) becomes much more important. A newer and alternative view, the practice-based perspective emphasizes the action of knowing encapsulated within practices. It is the practice-based perspective upon which this research is based.

The introduction continues by outlining the aims and objectives of the research. This is followed by providing details of the research methodology chosen. Brief outlines of the research contributions made by this research are then provided. This chapter finishes by outlining the structure of the thesis to follow.

1.1 OUTLINE OF THE KNOWLEDGE MANAGEMENT RESEARCH AREA

The literature on knowledge management is structured into two relevant sections. First, the literature in this area focuses on using technology to manage knowledge and so treats knowledge as an object which can be stored and transferred within information systems or what are increasingly referred to as knowledge management systems. This perspective does recognize the need for knowledge workers. It sees them as essential for knowledge creation and application focusing on the tacit knowledge they possess and how this is used in their interactions with knowledge management systems. Second, and the most important literature stream for this thesis, is an examination of the practice-based view in knowledge management. This is concerned not with knowledge as an asset held either explicitly in knowledge management systems or tacitly by knowledge-workers, but rather as a capability to enact relevant practices to accomplish knowledge intensive work.

1.1.1 THE TRADITIONAL KNOWLEDGE MANAGEMENT PERSPECTIVE

Initially the literature on knowledge management focused on the forms knowledge could take, and how this changed over time. This research enabled the development of various classification schemes and lifecycle models in the literature. Typically these models involve knowledge taking on a more codified form as the underlying reality they seek to explain is exploited by the organisation. A key organisational objective for much of this research was to improve organizational efficiency to ensure that the knowledge management systems and organisational mechanisms used by the organisation for managing knowledge were suited to the relevant type of knowledge.

This perspective was epistemologically founded in objectivism, with knowledge viewed as an entity reflecting an objective reality. An underlying assumption of this early research was that knowledge was an object capable of existing separately from those people who created and used it. It was seen as an organizational asset that could, through the use of knowledge management systems, be stored explicitly and leveraged so as to make it available for use across an organization. While an early distinction was made between explicit and tacit knowledge the latter was seen as initially necessary for knowledge creation (exploration) but needed to be codified and systematised if it were to be leveraged and efficiently exploited.

Proponents of the knowledge-as-object view accepted workers, with inherent tacit knowledge, were necessary to initially create and subsequently use knowledge. The rise of the knowledge-worker, particularly in macro-economic analysis tended to use certain industries and the job categories to argue for the increased importance of knowledge workers in modern economies.

At certain times employees' tacit knowledge was viewed as making knowledge intensive processes, such as knowledge transfer, more inefficient. The knowledge-as-object perspective argued that increased efficiency was achieved when a reliance on tacit elements was reduced so that, in creating in using knowledge, employees could access all the knowledge that was required to carry out work through knowledge management systems. In taking an epistemologically positivist stance any ambiguity in knowledge work was amenable to codification. Whether codification occurred depended on the costs of extraction from a tacit format and conversion to a reusable format. Over time, as more of the knowledge required for a business were 'discovered' areas of ambiguity previously requiring tacit knowledge were replaced by knowledge management system automation.

However, the literature on the knowledge-worker does not exclusively focus on their tacit knowledge but also the associated skills necessary to carry out on a day to day basis such as the need for social interpersonal skills, the ability to collaborate with others as well as issues around self identity and motivation. Thus the idea of the knowledge-worker requires a richer analysis than is currently offered using the knowledge-as-object perspective. It is argued that this richer, additional understanding can be provided to some extent by a using the practice-based perspective on knowledge management.

1.1.2 THE PRACTICE BASED PERSPECTIVE

Rather than viewing knowledge as an object, as previously outlined, this perspective looks at the act of 'knowing'. This knowing is exhibited constantly by the practices used by workers as they go about knowledge work. Of central interest are how practices are enacted and to gain a rich understanding of the rationale (why) for the existence of these practices. The interest in practices is useful for a number of reasons. A problem from a

managerial viewpoint is that it is more difficult to manage knowledge-workers because, due to the specialization of labour, change and obsolescence of the underlying knowledge base managers do not understand the details of their work and so must manage more by the output of knowledge-workers than by seeking to manage the processes in which they engage. This can mean that organizational descriptions of knowledge work may bear only a passing resemblance to the reality of what is done. Where knowledge management systems are relied upon extensively it is important that they are designed to support the requirements of the users' actual work practices.

The practice-based perspective adopts an alternative epistemological stance to the previous view: knowledge is not seen as an object but rather as a socially constructed practice. Reality is understood as an ongoing process where tacit and explicit knowledge are inseparably related and knowledge is inextricably linked to action. This is accomplished by workers enacting socially constructed practices. Writers in this practice-based view draw heavily on concepts contained in Structuration Theory and so, in order to place this perspective in context, this thesis provides a discussion of the main tenets of Structuration Theory. It goes on to explore how these tenets have been developed and used in the areas of information systems. Chapter 3 reviews the literature on the theoretical perspective that underpins this thesis. It outlines the main concepts not just in the practice-based literature paying particular attention to examining concepts as they have developed from Structuration Theory. As the practice based view takes an epistemological stance on what knowledge is it is logical to continue with a discussion in chapter 4 of methodological issues and choices for the research.

The concepts underpinning the practice based view will then be applied in chapters 6 and 7 to gain a rich understanding of work practices and in doing so should achieve the aims and objective of this research which are outlined in the next section.

1.2 RESEARCH AIMS AND OBJECTIVES

This section outlines the aims and objectives of the research. After each aim are the objectives used to achieve it.

This research uses the practice-based view of knowledge management as a theoretical basis. An aim of this thesis is to extend this stream of research. To do so requires the research to provide empirical evidence that increases an understanding of knowledge management practices.

This research aims to examine knowledge-intensive work which requires the application of an underlying knowledge base to non-programmed work. To do this it will analyse work by breaking it down into its constituent practices and sub-practices.

Structuration Theory has previously been used as a meta-theory. An aim of this research seeks to apply structuration at a more micro level. To achieve this application the research will examine work practices in detail using the main tenets of Structuration Theory. The modalities of structuration will be used to analyse sub-practices in terms of; relevant shared stocks of knowledge-the meanings that exist and are used by those enacting a particular practice, the work of norms that act to define what is the legitimate behaviour when accomplishing knowledge-intensive work, and also how and when resources such as knowledge management systems are drawn upon. Given the non programmed nature of the work this study will seek to identify how agency is used by knowledge workers to decide on the rules and resources that they will use in particular circumstances.

The research aims to understanding why the identified practices are so instantiated. To do this will require an understanding of the relevant work context, and the choices available to employees to accomplish work. It will involve accessing the detail of day-to-day work practices and discovering why employees chose certain courses of action over others to achieve a particular goal. This will be aided by a structural analysis of the practices.

1.2.1 CONTEXTUAL SETTING

The case company chosen was an American multinational that sold 'storage solutions'. It assembles and stress tests storage hardware, installing related software concerning backups, archives, and network attached storage. Importantly it also wrote and installed software that monitored the storage systems on clients' sites. The software defined problems using an organisational taxonomy of error codes. A report detailing all errors, and the likely severity of the problem, was collated and this report sent to Pi-Corp's product support department. This was known as a 'dial-home'.

This research focuses on the hardware and software product support departments located in Ireland. They are presented with technical problems from an automated case management system that handles 'dial homes' and a distributed (phone) call management system that manages calls from clients. This department deals with large corporate systems, with clients from the Forbes top 100 companies to mid-range corporations across the globe. These workers access various sources of information including a knowledge management repository in seeking to find the correct series of actions to resolve a customer's problem. The knowledge base they work from is technical, very detailed and specific to their company's range of products. They are also responsible for writing up new solutions for inclusion in the knowledge management repository. This study focuses on the practices and sub-practices used by these workers as they resolve problems and document solutions.

1.3 RESEARCH METHODOLOGY

Most research methodology chapters begin by examining epistemological and ontological positions regarding the nature of reality. In this thesis these issues are revisited, having been initially considered in earlier literature chapters when discussing the underlying assumptions of both perspectives on knowledge management. The research methodology chapter argues that by placing the research within the practice based view, and drawing heavily on Structuration Theory, an interpretivist stance is the most appropriate. This is because, from a structurational and practice-based perspective, reality is viewed as a social construct with recurrent structuring practices developed through acts of agency as individuals make sense of their situation.

It was decided to use a case study to analyse the knowledge management practices within a single company's environment. Given the importance of the context in which knowledge work is carried out it was felt that a focused, more in-depth examination was important. This choice enabled more data to be gathered on practices related to one particular work context.

The case company to be selected had to meet a number of requirements. The workers on which the research focused needed to be engaged in knowledge intensive work requiring them to be involved in the creation and manipulation of knowledge and draw on an existing and changing underlying knowledge base. The completion of their work should rely heavily on information systems, though ideally the company would have implemented what they would refer to as knowledge management systems (more to suggest a change in organisational emphasis than any monumental increase in functionality).

The objective of the research was to examine practices used to accomplish knowledge work in a particular work context. Interviews were chosen as the primary means of data collection. Because the work context was relatively unexplored and in need of research (Jones and Karsten, 2008), for the detail required the researcher decided that semi-structured interviews were appropriate as they allowed the researcher more latitude to explore the practices being discussed. To understand the relevant work practices from a range of perspectives it was decided to interview knowledge workers with different levels of experience, asking them to describe aspects of their work and their rationales for taking certain actions. This would provide data from those new to enacting practices to those more experienced and adept at knowledge work. In addition, by interviewing managers and those involved in knowledge management in the firm, additional perspectives were accessed. Interviewing ceased when little new issues were being presented i.e. theoretical saturation was reached.

In addition access was given to review the knowledge management repository, with customer level access. This enabled the researcher to examine the output of the knowledge practices discussed in interviews. In addition, participant observation showed the researcher how the knowledge management and other systems were used in the work context.

Data analysis involved using nVivo qualitative analysis software package to code the phenomena that emerged from the data, so as to create a representation of the social practices being examined. Induction, rather than a statistical analysis, resulted in analytic rather than statistically generalisable findings. This required identifying patterns in the data and seeking to understand the relationships between the emerging concepts. Potential concepts were developed and considered in light of the data, requiring iterations between developing concepts and returning to the specific detail of the data.

1.4 RESEARCH CONTRIBUTION

The research contribution of this research falls into a number of areas. Firstly, as outlined in section 8.3.1 it helps extend the literature on Structuration Theory and the newer research stream on the practice-based view of knowledge management. It extends the former, which is more established, by seeking to use structurational analysis at a more micro level of activity rather than as a mid-level theory. By examining a number of work practices it helps the latter by showing how this view complements the more traditional view of knowledge as an object. Secondly, it provides additional research as detailed in 8.3.2 to research on knowledge management in organisations. While early research was focused more on settings where knowledge work was less programmed and more creative, necessitating more ‘management’ this research examines a work context in which knowledge work exists but is seen to be at the more structured end of the spectrum. Finally, in section 8.3.3 the contributions made to the literature on call centre work are outlined.

1.5 STRUCTURE OF THE THESIS

The thesis begins with two literature based chapters that outline (a) research on the traditional knowledge-as-object perspective, (b) a discussion of knowledge workers which by showing additional requirements beyond possession of tacit knowledge (Chapter 2). Focus then moves to a discussion of the knowledge management from a practice-based perspective (Chapter 3). Once the theoretical background is in place a discussion of the research methodology follows (Chapter 4).

The next three chapters relate to the case study. First Pi-Corp is introduced and placed in context by comparing and contrasting it with the literature on call centres (Chapter 5). Next two of the main practices are examined. The case analysis process is examined (Chapter 6), followed by the solution documentation practice (Chapter 7).

The thesis finishes by outlining the conclusions, limitations, areas for future research and the research contributions made (Chapter 8).

2 THE TRADITIONAL KNOWLEDGE MANAGEMENT PERSPECTIVE

There are two main perspectives on knowledge management: the traditional knowledge-as-object view and the practice-based perspective, Hislop (2005). This chapter will begin by exploring the former. It will start by outlining categorisations of knowledge used in the knowledge management literature (section 2.1). Though one categorisation of knowledge involves a spectrum between tacit and explicit forms the objective of this viewpoint is to manage knowledge primarily by making tacit knowledge explicit where possible. A large part of the early knowledge management literature considered the relevant stages required for such a knowledge management life cycle. Section 2.2 seeks to integrate the work of various researchers by outlining 6 stages along with what were seen as relevant issues. The chapter continues by outlining the underlying assumptions about knowledge and considering their implications for management. Though this perspective was the standard view of knowledge management in its early years, providing a structure to the research area, over time it was subject to a number of criticisms. These are outlined in section 2.3

Because the thesis seeks to examine knowledge-intensive non-programmed practices section 2.4 briefly reviews the growth of the ‘knowledge worker’ and goes on to consider how knowledge work is different in section 2.4.1. The attributes of knowledge workers are described in section 2.5. This literature was used to create evaluation criteria when examining potential research sites as defined in section 4.4.1.

2.1 KNOWLEDGE CATEGORIES

There are two broad epistemological camps within the knowledge management literature the ‘objectivist’ and ‘practice-based’ perspectives, Hislop (2005) also referred to as the objective and, subjective or intersubjective perspectives, (Schultz, 1998, Burrell and Morgan, 1979, Venters et al., 2002).

The objectivist view sees knowledge as an entity or object (Hislop, 2005, Schultz, 1998) that is representative of the world, awaiting discovery, (Schultz, 1998). It is predicated on

a positivistic philosophy that sees knowledge as ‘objective facts’, (Hislop, 2005). The majority of the literature on knowledge has taken this position (Hislop, 2005). (Schultz, 1998), drawing on (Burrell and Morgan, 1979), argues that subjective/objective views of knowledge are binary extremes of a continuum. Many authors within an objectivist epistemological framework argue that there is an underlying ‘either-or’ dichotomy or dualism: knowledge is seen as either tacit or explicit, (Hislop, 2005). Due to its transferability, proponents of the objectivist view concentrate on processes whereby tacit knowledge can be made explicit, structured and shared, (Hislop, 2005).

Explicit knowledge is seen as codifiable and objective, (Jensen and Meckling, 1995, Zack, 1999b) knowledge involving objective facts and propositions or having access to information (Alavi and Leidner, 2001) and is itself an object or entity, (Alavi and Leidner, 2001, Sorensen and Kakihara, 2002). Domain specific knowledge involves experience but also study, (Tiwana and Ramesh, 2001). A number of classifications have been used by various authors in the ‘taxonomic’ camp who seek to classify organizational knowledge and its implications, (Tsoukas, 1996). What is important is that the classification is organizationally useful, (Alavi and Leidner, 2001). Barthes & Tacla (2002) distinguish between company knowledge, which involves technical knowledge within the company, and corporate knowledge which is used by management at a corporate level.

Explicit knowledge is seen as declarative (Zack, 1999b), with terms used such as ‘know-about’ such as the appropriate drug for an illness, (Alavi and Leidner, 2001). Additionally it may include ‘know-what’ or the ‘what’ perspective (Kingston and Macintosh, 2000), which involves the development of categories and classifications as opposed to seeing ‘what’ as procedure, as is the case with those who see processes (Alavi and Leidner, 2001, Sorensen and Kakihara, 2002). Know-what is also seen as involving processes (Zack, 1999b, Alavi and Leidner, 2001). Knowledge about ‘how’ concentrate on the actions required for an event to occur (Kingston and Macintosh, 2000). Know-how is procedural knowledge (Kogut and Zander, 1992) involving an understanding of a current state or products and processes, (Sanchez, 1997) the procedure around how errors occur (Zack, 1999b) as well as the actions to follow (Alavi and Leidner, 2001).

Authors may also refer to codified knowledge relating to causation (Zack, 1999b) involving ‘know-why’ which involves theoretical understanding (Sanchez, 1997) about

cause and effect (Alavi and Leidner, 2001) providing rationales and justifications for events (Kingston and Macintosh, 2000), knowledge conditional on time. Another category, ‘know-when’ (Alavi and Leidner, 2001) relates to the ordering or timing of events (Kingston and Macintosh, 2000). Interconnections and interdependencies are defined as ‘know-with’(Alavi and Leidner, 2001).

Table 1: Knowledge Categories

<i>Knowledge Type</i>	<i>Definitions</i>	<i>Authors</i>
Know-How	Procedural	(Borgatti and Cross, 2003)
	Skills and capabilities	(Cheung, 2006)
	Based on experience	(Leonard and Swap, 2004)
	Competencies	(Lazaric et al., 2008)
	Predominantly intangible with only a small portion codifiable	(Soo et al.)
	Step-by-step procedures	(Lee and Strong, 2003)
	Relatively automatic	(Lindkvist, 2005)
	Expertise or accumulated practical skill	(vonHippel, 1988)
	Defines current practice within a firm	(Kogut and Zander, 1992)
	At individual level- a skill	(Kogut and Zander, 1992)
	At group level- a recipe	
	At firm level- organising principle	
	Tacit knowledge of a technical nature	(Katsamakos, 2007)
	Has a personal quality making it difficult to formalise and communicate	(Murray and Peyrefitte, 2007)
	The ability to put ‘know-what’ into practice	(Seely-Brown and Duguid, 1998)
Embedded in work practices		
Produced and reproduced through practices	(Giddens, 1984) referred to in (Seely-Brown and Duguid, 1998)	
“know-how is <i>in</i> the action”	(Schon, 1983:50) referred to in a commentary by Orlikowski on a reprint of (Seely-Brown and Duguid, 1998)	
Skills and capabilities to do something	(Charles, 2006)	
Practical experience gained through tacit learning		

Know-Why	<p>Scientific knowledge and understanding- principles of 'why' events happen (Cheung, 2006)</p> <p>Experience and understanding of cause and effect relationships (Lee and Strong, 2003)</p> <p>Principles and laws to reduce trial and error (Charles, 2006)</p>
Know-What	<p>Declarative (Borgatti and Cross, 2003) (Lee and Strong, 2003)</p> <p>Knowledge about facts (Cheung, 2006)</p> <p>Information on activities and relationships- fact based (Lee and Strong, 2003)</p> <p>Explicit knowledge that can be shared (Seely-Brown and Duguid, 1998)</p> <p>Circulates with relative ease (Charles, 2006)</p> <p>Facts and information</p>
Know-Who	<p>A function of relationships (Borgatti and Cross, 2003)</p> <p>Where knowledge is stored- particularly the knowledge owner (Cheung, 2006)</p> <p>Connect to experts within and outside the organisation (Pollard, 2005)</p> <p>Information about who knows how to do what (Charles, 2006)</p>

Explicit knowledge is seen as impersonal and context independent, (Hislop, 2005) and is not 'located' in a particular place, (Schultz, 1998). Where knowledge is viewed as an object, (Venters et al., 2002) it represents part of a 'pre-given' world, (Sorensen and Kakihara, 2002). Knowledge is viewed by positivists as universal and objective and easy to transfer, also static and representing a pre-given external reality, (Stankeviciute, 2001). The literature on knowledge was initially reliant on a cognitivist/positivist epistemology which relied on 'representationalism': that it was possible to create in the mind a representation that corresponded to the external world, making truth and thus knowledge dependant on the degree of correspondence that could be achieved, (Stankeviciute, 2001). The cognitivist perspective also assumes that knowledge can be achieved by the brain

through logic and deduction, making human competence in knowledge creation resultant from the making of logical propositions to describe the external world. (Stankeviciute, 2001).

Research by those in the knowledge-as-object 'camp' is typically ahistorical and problematic because: it does not consider the unintended consequences of its recommendations, such as codifying tacit knowledge; and it assumes that knowledge is 'good' with more being preferable to less, ignoring the double-edged nature of knowledge; finally by assuming actors are rational means behaviours that are wilful and coercive fall outside the functional perspective that views power and knowledge as distinct, (Schultz, 1998).

Leonard & Sensiper (1998) take the view that tacit and explicit knowledge are opposing ends of a spectrum, with all knowledge having to some degree a tacit dimension. "*Tacit knowing embodied in cognitive skills is likewise learned through experience and resides in the unconscious or semiconscious*" (Leonard and Sensiper, 1998:113). Stankeviciute (2001) traces the idea of tacit knowledge from the distinction made by Polanyi (1958) to the management literature in the work of Nelson & Winter (1982) who saw organizational adaptation in terms of organizational routine: some of which were explicit bureaucratic rules, while others were tacit and existed in the organizational culture with interaction between both. Their boundaries can be seen as flexible and transparent. Tacit knowledge is also seen as embedded in actions, experiences and involvement within a specific context: involving both 'mental models' about cause and effect relationships as well as "technical tacit" which involves 'know-how' in a particular context such as surgery skills, (Alavi and Leidner, 2001).

Stankeviciute (2001) sees views of knowledge as explicit or embrained as falling within the positivist camp whereas embodied, tacit or embedded/encultured knowledge falls within the realm of constructivism. Here it is possible to separate knowing and learning from action as it is argued that one can gain new knowledge without a resultant change in behaviour, (Stankeviciute, 2001). However in considering those who view organizations as similar to a mind Tsoukas (1996) refers to Ryle (1949) where the mind is not seen as a 'given property' but rather as a "style of action- a pattern that is manifested in action".

Knowledge is seen as subjective and linked to action and meaningful behaviour, (Leonard and Sensiper, 1998).

While Nelson & Winter (1982) argued that the organization is capable of knowing, separate from its employees' conscious knowledge, through the tacit rules existing in an organizational culture, for Nonaka & Takeuchi (1995) organizational knowledge involves shared mental maps and sets of schemas, Stankeviciute (2001). A collective mind manifested in the interrelationships of individuals' actions, so that the individual and collective minds are mutually constitutive as an 'emergent joint accomplishment' with it becoming more constituted as individual contributions become more 'heedfully interrelated' over time, (Tsoukas, 1996).

For those who see knowledge as a 'state of mind' or a state of knowing and understanding then knowledge management involves ways of enhancing actors' learning and understanding by providing them with information, so that IT plays a part in this information provision, (Alavi and Leidner, 2001). Where knowledge cannot be codified and remains to an extent tacit it is associated with human subjectivity with knowledge being the interpretation of the individual which simultaneously shapes and is shaped by social reality, Sorensen & Kakiyama (2002) (referring to the work of Berger & Luckman 1966) and cannot be understood without considering human interpretivist behaviours.

Jimes & Lucardie (2003) see three categories of tacit/explicit knowledge: knowledge is explicit; knowledge is tacit but can be formalized; and, tacit knowledge exists that cannot be formalized. For (Zack, 1999b) the decision of which knowledge should be made explicit and which should be left tacit as a fundamental challenge.

Figure 1: Knowledge Articulability

	Inherently or potentially articulable	Inherently inarticulable
Knowledge is articulated	Exploited opportunity	The essence of the knowledge may be lost
Knowledge is not articulated	Lost opportunity to store/leverage	Respects tacit knowledge's power & limits

(Zack, 1999b)

Subjective or tacit knowledge is seen as being ‘embrained’ (Tsoukas, 1996, Stankeviciute, 2001) involving cognitive skills, mental constructs and frameworks (Hedlund, 1994), and may be a state of mind, (Alavi and Leidner, 2001) included as individuals experiences and interpretations (Sorensen and Kakihara, 2002, Leonard and Sensiper, 1998), which give it meaning and context through the act of reflection (Davenport, 1997), as well as being equated with the mental act of information processing (Sorensen and Kakihara, 2002) so that it is specific, relating to a particular domain, and difficult to share and is ‘embedded’ or ‘encultured’ (Stankeviciute, 2001, Nonaka and Takeuchi, 1995). As well as being related to the mind knowledge can also be ‘embodied’, (Stankeviciute, 2001), in products, artefacts or individuals, (Hedlund, 1994). Some writers also comment on the purpose of knowledge which is to *"provide a framework for evaluating and incorporating new experiences and information"* Davenport & Prusak (1998:5)

Knowledge identification and codification are based on a positivist view of knowledge and may be implicit in work where the author, which acknowledging tacit knowledge, believes it to be codifiable, (Stankeviciute, 2001). Alavi & Leidner (2001) argue that those who rely heavily on the tacit-explicit and individual-collective distinctions fail to provide a comprehensive explanation regarding the interrelationships between the knowledge types. A problem with the tacit-explicit, individual-collective classification is that tacit knowledge is assumed to be more valuable which is equivalent to an inability to articulate knowledge with an inherent worth, (Alavi and Leidner, 2001).

Alavi & Leidner (2001:112) see tacit and explicit knowledge, not as dichotomous states but rather as *"mutually dependant and reinforcing qualities of knowledge: tacit knowledge forms the background necessary for assigning the structure to develop and interpret explicit knowledge... The inextricable linkage of tacit and explicit knowledge suggests that only individuals with a requisite level of shared knowledge can truly exchange knowledge"*.

While the tacit-explicit distinction is seen as useful, to the extent that it makes organizations cognisant of the need to manage their entire knowledge base, it is inadequate as a guide to knowledge management processes, (Jimes and Lucardie, 2003). These authors argue that the tacit-explicit distinction, does not ‘concretely substantiate’ the link

between the organizations goals and the role of knowledge in achieving those goals, further arguing for a 'goal orientation'.

According to Hendriks & Vriens (1999), the focus of knowledge management should be threefold: making the right knowledge available to the correct person when needed, the avoidance of knowledge erosion through the development of a corporate memory, and the assurance that conditions for innovation and knowledge creation are present. The potential for knowledge based systems relates to their ability to define knowledge models and improve access to knowledge stores in a knowledge base, with the downside being a bias that ignores tacit knowledge, (Hendriks, 1999).

2.2 KNOWLEDGE LIFECYCLE MODELS

A large number of researchers have viewed knowledge management as a series of stages through which knowledge is processed. Such a viewpoint suited early proponents of knowledge management who were typically focused on how to use information technologies to structure knowledge so that it, and its associated processes and workers, were amenable to being managed. As the table on the next page illustrates there is not agreement on a common set of stages in knowledge lifecycle models.

Having outlined the main stages in the knowledge lifecycle the following sections (2.2.1 to 2.2.6) outline the necessary processes and issues involved in managing knowledge at each stage.

Table 2: Stages in Knowledge Lifecycle Models

<i>Authors</i>	Pre-Create	Create	Capture	Transfer	Apply	Post-Application
(Hendriks and Vriens, 1999)	•	•	•	•	•	•
(Boisot and Cox, 1999)	•	•	•	•	•	•
(Alavi and Leidner, 2001)		•	•	•	•	
(Wiig, 1993)		•	•	•	•	
(Tyndale, 2001)		•	•	•	•	
(Bukowitz and Williams, 2000)		•	•	•	•	•
(Carayannis, 1999)	•		•	•	•	•
(Depres and Chauvel, 1999)	•	•	•	•	•	•
(Demarest, 1997)		•	•	•	•	
(Martensson, 2000)		•	•	•	•	
(Angus et al., 1998)			•	•		
(Jackson, 1999)			•	•		
(Meyers and Zack, 1996)		•	•	•	•	
(Stankeviciute, 2001)		•	•	•		
(McElroy, 1999)		•	•			
(Sorensen and Kakihara, 2002)			•	•		
(Wiig et al., 1997)			•	•	•	
(Venters et al., 2002)			•	•		

2.2.1 PRE-CREATION

Some authors see scanning as an important phase, occurring prior to knowledge creation. This involves the firm looking for weak signals to identify threats and opportunities, (Boisot and Cox, 1999). For Depres & Chauvel (1999) this can be at an organizational or individual level and requires a balance between scanning widely for weak signals (divergence) or taking a narrower (convergent) focus. Environmental scanning that assesses competitors knowledge, coupled with an assessment of the strategic value of current knowledge enable a firm to identify the knowledge required prior to the creation phase, (Hendriks and Vriens, 1999).

2.2.2 CREATION

Hendriks & Vriens (1999) focus on the creation of new knowledge, though as (Tyndale, 2001) argues that new knowledge only has to be new to the specific firm. Bukowitz & Williams (2000) argue knowledge is created during a problem-solving phase as well as during decision-making and innovation. This phase includes those researchers who define creation in terms of knowledge ‘acquisition’ and also those who focus on knowledge ‘development’.

Regarding knowledge acquisition Stankeviciute (2001) argues that there are two main issues: benchmarking, where knowledge is acquired by transferring it, and business intelligence where data and information are transferred and subsequently turned into knowledge through the use of experience, analytic techniques and judgement, involving the production of new knowledge. The knowledge acquisition activity always involves existing knowledge when formal means are used to transfer explicit knowledge whereas individual or collective tacit knowledge (embedded or encultured) involves recreating the knowledge in a new context, (Stankeviciute, 2001). Knowledge acquisition and capture, (Depres and Chauvel, 1999) involves environmental scanning which may in itself provide new insights, (Boisot and Cox, 1999) with this scanning activity dependant on what was previously judged to be valuable, (Depres and Chauvel, 1999).

Firms can extract knowledge from information sources (Wiig, 1999) and build knowledge by importing it from books, as well as from peers with formal education and training or informal personal experience, (Wiig, 1993). Consideration needs to be given to the sources of data such as the breadth, depth, scope, relevance, cost, control, accuracy, credibility and exclusivity to ensure acquired data is of the highest quality, (Meyers and Zack, 1996). The danger of information overload must also be managed at this stage, (Bukowitz and Williams, 2000).

Some authors argue that knowledge exists awaiting discovery which then requires coherence and structure (Demarest, 1997, Boisot and Cox, 1999), a positivist view. Structure may be given by a process of abstraction to identify patterns and explain relations between different knowledge contexts, (Wiig, 1999), with knowledge 'claims' being formulated with acquired information used to validate or falsify so that claims, with validated information being re-termed knowledge, (McElroy, 1999). Verification is required to ensure that the abstracted material still retains its original meaning and has not been corrupted, (Wiig, 1999).

2.2.3 CAPTURE

Information technologies are key in this phase. The storage phase provides a bridge between knowledge acquisition and knowledge use, (Meyers and Zack, 1996). Once acquired, content must be 'refined' or standardised in a generic format (Meyers and Zack, 1996, Bukowitz and Williams, 2000) within a repository. It should be organised logically, (Martensson, 2000) classified and categorised, (Tyndale, 2001) through processes of synthesis and reconstruction, (Wiig, 1993).

Processes should also be in place to filter out irrelevant knowledge which presupposes that it is possible to interpret the meaning of the knowledge the repository contains, (Tyndale, 2001). These processes may be facilitated using organizational frameworks such as a knowledge-ontology or taxonomy, (Wiig, 1993).

A key concern at this stage is the 'issue of effort versus reward' regarding the codification of knowledge, (Sorensen and Kakiyara, 2002). Here learning involves the creation of knowledge that is a truthful and accurate representation of an objective reality, (Sorensen and Kakiyara, 2002).

While knowledge may exist in various forms (Schultz, 1998, Venters et al., 2002) the primary objective of this perspective is to codify it using technology, (Venters et al., 2002, Alavi and Leidner, 2001). The assumption is that knowledge can exist separately from those who create it, (Stankeviciute, 2001). This results in a 'mechanistic, technology-driven knowledge discourse', that dominates management studies, (Sorensen and Kakiyara, 2002). Knowledge mapping activities enable an inventory of knowledge assets, defined in terms of their form, location and content and, when used in conjunction with a SWOT analysis to identify bottlenecks, (Wiig et al., 1997). It also enables resource allocation by assessing critical knowledge against future requirements, (Bukowitz and Williams, 2000).

The act of storage requires employees to add to the repository what they believe will benefit the firm (Bukowitz and Williams, 2000). Some see this stage as choosing a 'container' for knowledge (Demarest, 1997) integrated using data dictionaries and online databases, (Tyndale, 2001). Media choice is viewed as the mundane part, the important issue being the representation, codification and extraction of meaning (which are not taken to be pre-given), whether in manuals or repositories, (Wiig, 1993). Once there is a procedure to codify knowledge there must also be a decision made to integrate new knowledge into the repository, (McElroy, 1999). As well as accumulating knowledge in an organizational memory it may also be embedded in organisational procedures and processes, (Wiig et al., 1997).

2.2.4 TRANSFER

Stankeviciute (2001) identifies two views of knowledge transfer: one which believes ICTs are capable of transferring all knowledge and a second (dominant view) which sees explicit knowledge as capable of direct transfer with a group of authors, taking a constructivist approach, seek mechanisms for facilitating the indirect transfer of tacit knowledge so that it can be adapted to new contexts: this requires knowledge 'recreation' rather than transfer,

(Stankeviciute, 2001). While strictly speaking knowledge can only be created by an individual, it may occur through social interaction, with the organisation providing the context, (Nonaka and Takeuchi, 1995). Both tacit and explicit knowledge can be present at a number of levels the individual, the organization (Kogut and Zander, 1992) (see Figure 2: Knowledge Type and Level of Diffusion) as well as interorganisationally, Sanchez (1997) and also at group level (Hedlund, 1994, Nonaka & Takeuchi, 1995). Knowledge is categorised as created at the individual or group level, the latter requiring collective action and communicative norms (Alavi and Leidner, 2001).

Figure 2: Knowledge Type and Level of Diffusion

	<i>Individual</i>	<i>Group</i>	<i>Organisation</i>	<i>Network</i>
Information	Facts	Who knows what	Profits Accounting data Formal & informal structure	Prices Whom to contact Who has what
Know-How	Skill of how to communicate Problem solving	Recipes of organising such as Taylorist methods or craft production	Higher-order organising principles of how to coordinate groups and transfer knowledge	How to cooperate How to sell and buy

(Kogut and Zander, 1992)

A consequence of viewing knowledge as an object is that there is a belief that it can exist at various levels (individual, group or organizational) (Schultz, 1998) to be located or discovered, (Venters et al., 2002) as well as concentrating on the creation and management of ‘stocks’ of knowledge, (Alavi and Leidner, 2001, Sorensen and Kakihara, 2002). Some authors distinguish between knowledge held at the individual level from all other forms be they labelled ‘common’, (Kogut and Zander, 1992), collective, (Matusik and Hill, 1998), or societal, (Spender, 1996). Of the typical four knowledge levels, (Depres and Chauvel, 2001, Nonaka and Takeuchi, 1995) three (individual, group and organisational) are within the firm boundary with one, the intra-organizational, external to the firm. The firm

boundary is also used to distinguish knowledge which is uniquely available to the firm as opposed to that which is external, (Zack, 1999b) or being available to a cluster of firms, (Tallman et al., 2004) as well as to a general market, (Boisot and Cox, 1999, Boisot, 1998).

Table 3: Units of Analysis for Knowledge Transfer.

Authors	Category name used for units of analysis.			
	Firm Boundary->			External
(Nonaka and Takeuchi, 1995)	Individual	Group	Organisational	Intra-Organisational
(Depres and Chauvel, 1999)	Individual	Group	Organisational	Intra-Organisational
(Boisot, 1998)		Fief	Bureaucracy	Clan, Market
(Kogut and Zander, 1992)	Specific	Common		
(Zack, 1999b)	Internal			External
(Spender, 1996)	Individual	Societal		
(Matusik and Hill, 1998)	Individual	Collective		
(Tallman et al., 2004)	Firm Specific			Firm Cluster Specific
(Matusik and Hill, 1998)	Component	Architectural		

At an individual level Sanchez (1997) argues that knowledge can be either articulated or unarticulated, with articulation being the ability of a person to explain their knowledge in such a way that it can be understood by at least one other person within the firm. The knowledge must be represented in such a way that another can attribute meaning to it. By individuals articulating their knowledge it is possible for the organization to identify its knowledge resources, (Sanchez,1997).

Within organizations Sanchez (1997) sees knowledge as being either codified or uncoded, "*to transfer the knowledge of individuals and groups within an organization, the knowledge sets shared by individuals in a specific context within the organization must be made comprehensible and available to other individuals in other contexts in the organization*" Sanchez (1997:172). The argument is that knowledge codification refers to several knowledge management processes: it identifies individuals and groups subject matter and knowledge sets in ways comprehensible to others; it requires the articulation of knowledge so it can be understood; by establishing categorisation schema it makes the knowledge accessible; it helps to clarify the relationships between knowledge sets (a knowledge processes map); it may make the knowledge architecture of the firm explicit which may facilitate coordination and enable linkages to be established. For knowledge to be apprehended interorganisationally the recipient firm must observe the knowledge in some way and comprehend it so that it can assess the value of the knowledge that may be transferred (Sanchez, 1997).

Knowledge management also needs to consider the processes surrounding the 'flow' of knowledge stocks as they are shared and distributed, with information technologies linking knowledge sources, in broader and deeper ways, (Alavi and Leidner, 2001). Some see knowledge sharing and the application of knowledge in the same stage, (Depres and Chauvel, 1999, Hendriks and Vriens, 1999) though most researchers categorise the sharing/transfer/diffusion separately. Once knowledge has been codified it can be disseminated using, among other methods, information systems, (Wiig et al., 1997) with Demarest (1997) stressing the need for human as well as technical infrastructure. Systems involve knowledge 'pooling': the assembly, accessing and retrieval of knowledge, (Wiig, 1993). Not only are the media used relevant but distribution must also encompass the frequency, timing language and form of the message, (Meyers and Zack, 1996). The dispersed nature of knowledge requires networks (Tyndale, 2001) so that knowledge is

coordinated, (Wiig, 1993). A wider definition of diffusion can include systems for communication and online collaboration (Tyndale, 2001) and knowledge management requires activities that consider 'who knows what' knowledge sources to facilitate access and retrieval of knowledge on a peer-to-peer basis, (Wiig, 1993).

In her review Martensson (2000) considers the level of diffusion: be it to everyone in the firm (LaPlante, 1997); more specifically where it can best be used, (Nerney, 1997); or to the right people at the right time, (Ostro, 1997). The larger the population the more difficult sharing context becomes so that, while well codified knowledge is transferable to a large population, uncodified or context specific knowledge transfer is problematic and achievable only through the sharing of the context by sender and recipient requiring tacit to tacit interaction for this to occur (Bukowitz and Williams, 2000).

The characteristics of knowledge that have critical implications for management (Spender and Grant, 1996) include the transferability of knowledge, dependent on its tacitness/explicitness. Upon receipt of the transmitted knowledge the individual or organization receiving it must add it to its existing knowledge base, with its absorptive capacity affecting its ability to add to its existing store of knowledge. The efficiency of aggregation is also enhanced if there is a common language between the sender and recipient. Another characteristic is that of appropriability of knowledge, the ability to earn a return that is equal to that created by the resource. In the case of tacit knowledge it is not appropriable directly, only through its application. Explicit knowledge is appropriable as it can be transferred directly. Codification increases the ability of the knowledge being apprehended by competitors, and so the knowledge 'asset' must be controlled (Sanchez, 1997) However knowledge is generally inappropriable through market transactions as most of the explicit knowledge and all of the tacit is stored within people and so there is ambiguity over ownership, as well as that the knowledge created within the firm is firm specific. Knowledge is also seen as a primary source of knowledge and a critical input for production. Specialization is required in order to create and acquire knowledge given bounded rationality of individuals (Grant, 1996).

2.2.5 APPLY

The use of knowledge to provide value to a firms' customers is the ultimate objective of knowledge management systems, (Demarest, 1997). Depres and Chauvel (1999) argue that it had become accepted in the field that knowledge was only known through action with use viewed as a social process, Laberis (1998) quoted in Martensson (2000). A number of descriptions of how knowledge is used are provided by (Wiig, 1993), quoted in (Dalkir, 2005) who sees it as: to determine or describe the scope and solutions of a problem; to synthesise alternative solutions; to analyse a situation; to suit specialist knowledge to a situation; to decide on a course of action; and to implement a selected alternative.

Fostering innovation requires information be combined in ways that are novel, (Bukowitz and Williams, 2000). While knowledge may be used to perform routine tasks (Wiig, 1993) this requires 'compiled' knowledge which is readily accessible and may occur automatically, while more difficult tasks are completed more deliberately and consciously as such automated knowledge cannot be used in unanticipated contexts, (Dalkir, 2005). As knowledge may be embedded in work processes and used within particular contexts (Wiig, 1993, Meyers and Zack, 1996), an initial question is whether what has been delivered from a repository provides the end user with sufficient context to make use of the content.

The application by a recipient of the transferred knowledge to particular circumstances may be supported by uncodified knowledge, (Boisot and Cox, 1999). The application and sharing of knowledge should result, through 'reuse', in organizational innovation and transformation, (Depres and Chauvel, 1999). The application of knowledge is affected by the way the organization is structured (Tyndale, 2001). Part of the 'act' phase, (Wiig et al., 1997) involves the combination and consolidation of knowledge.

After the application of knowledge Bukowitz & Williams (2000) argue that, in order to generate new ideas, there should be a 'learning stage' involving reflection on experiences.

2.2.6 POST-APPLICATION

Towards the end of the knowledge management cycle, knowledge may become embedded in firstly firm, and then industry practices (Boisot and Cox, 1999). At the latter stages of lifecycle models, the sharing and using of knowledge leads to organizational transformation through resulting innovations and an evolution to the demands of the firms' environment (Depres and Chauvel, 1999). Organisational performance should be monitored and evaluated at a review stage (Wiig et al., 1997) where a cost benefit analysis should be used to determine the retention or obsolescence of knowledge, (Bukowitz and Williams, 2000, Hendriks and Vriens, 1999).

2.3 CRITICISMS OF THE SUBJECT/OBJECT PERSPECTIVE

Orlikowski (2002b) outlines what she sees as two research streams on organizational knowledge. The 'taxonomic' view attempts to arrive at various classifications of knowledge in a belief that examining how various types of knowledge are created, transferred, codified and converted may increase the effectiveness of techniques, routines and strategies used by organizations. The development of taxonomies by researchers enables them to develop a contingency theory that outline the appropriate knowledge management solutions for different types of knowledge (Schultz, 1998).

Classification schemes assume that the observer is capable of discerning systematic similarities and differences between objects: a problem being that the conceptual categories are assumed to be stable, discrete and separate which is rarely the case (Tsoukas, 1996). While the focus is claimed to be the 'actuality' or the way society works, their categories for knowledge types are developed theoretically a priori, a particular issue being the dualism of tacit and explicit knowledge that raises the issues of conversion between types yet ignores the interdependence and mutually-constituting nature between the types: indeed such a dualism is not reflexive of reality and are difficult to discern empirically, (Schultz, 1998).

A proportion of this 'taxonomic view' treats knowledge as an entity capable of capture, storage and transmission or alternatively a 'disposition' which can be individually or collectively held which results in either 'objective reification' or 'subjectivist reduction' (Orlikowski, 2002b). The literature on knowledge work predominantly presupposes the view of knowledge as an entity that is amenable to ownership and capable of being traded (Hayes, 2001).

The objectivist view assumes that knowledge is an asset, owned by the firm: it is seen as a private good which people will codify and share for the same organisational incentives used for other work practices: though (McLureWasco and Faraj, 2000) argue that knowledge is unlike other organisational commodities citing (Constant et al., 1994). Even when some knowledge is codified research by (O'Reilly, 1982) found that people sought information which was easily accessible rather than search for the best information.

Another criticism of the knowledge-as-object approach is that it may 'reify' knowledge and may treat it as a 'stock' or a 'set of discrete elements' rather than seeing tacit and explicit knowledge as inseparable and mutually constituting, (Orlikowski, 2002b). Hayes & Walsham (2001) argue that it is not possible to separate knowledge from practice. Ellingsen (2002) believes that the concept of knowledge as an entity which an organization can own and store in databases is too narrow a perspective arguing that concentration needs to be placed on how individuals create knowledge and what they do.

Another categorisation sees knowledge as being tacitly embedded in individuals. It is not owned by the organisation but by the worker, who can choose what to do with it, (McLureWasco and Faraj, 2000). In this case knowledge sharing occurs in return for self-esteem and reputation, (Constant et al., 1994, Jarvenpaa and Staples, 2000). There is a problem for the firm where knowledge is embedded in people: it is not owned by the firm and is not a structural asset- it is not easily transferable leading to a danger of information overload as experts within a firm turn their attention from knowledge creation to dissemination, (McLureWasco and Faraj, 2000).

Schultz (2000) argues that a definition of knowledge remains 'elusive' with knowledge being difficult to study in and of itself. This agrees with Blackler et al. (1993b) in recommending that research in the area of knowledge work should concentrate on what

knowledge workers 'do' as opposed to what they 'know' i.e. research should concentrate on work practices. A third category is to see knowledge as existing within communities. This reduces the problem of information overload on experts, or others with tacit knowledge leaving or of contextualisation of knowledge (as a result of codification) as the community constantly regenerates and recontextualises knowledge as part of their ongoing work practices, (McLureWasco and Faraj, 2000).

2.4 KNOWLEDGE WORKERS

Boland & Tenkasi (1995) contend that firms are becoming more knowledge intensive across all sectors of the economy. Knowledge workers are important because organizations only exist as a result of human action and depend upon human agency for continued existence (Sveiby, 1997). In modern economies the primary resource being cited is knowledge, (Drucker, 1992, Blackler et al., 1993a). Organizational success relies more on intellectual and systems capabilities (rather than as previously its physical assets) as the economy moves into a post-industrial era (Quinn et al., 1996). This makes personnel the 'only significant resource' in the firm, (Alvesson, 2000).

These changes mean that future competitive advantage will depend on the ability capability of a firm to manage knowledge, knowledge workers and relationships through learning and collaboration, (Liedtka et al., 1997, Davenport et al., 1996) with a significant societal challenge being knowledge worker productivity (Drucker, 1993). Knowledge workers are valuable to a firm because of their ability to work effectively with 'ideas, symbols, and other abstractions' (Lee and Maurer, 1997).

Scarborough (1999) prefers to view the development of knowledge workers as being related to changing conditions of work brought about by industrial and technological change. The 'emergence' of knowledge workers is due to four developments (Scarborough, 1999): (a) the decline of a professional model; (b) the increase in importance of knowledge work in a number of occupations; (c) the 'codification and commodification of knowledge' due to ICTs; and (d) the development of new sectors of the knowledge economy involved in knowledge production.

It is a myth that it is only white-collar workers who engage in knowledge work as trends in manufacturing have the effect of changing knowledge work in factories, (Fisher and Fisher, 1998). The point is made specifically regarding ICTs that, while previously used to automate routine tasks, they are now becoming involved in the ‘routinization’ of ‘mind-work’, taking over tasks (such as the provision of mortgage advice) that was previously thought to be the province of knowledge workers, (Tissen et al., 2000). This raises questions about the degree to which information technology can automate the work historically undertaken by knowledge workers.

A result of changing organizational processes has been the growth of research into knowledge work (Hayes, 2001). The issue of knowledge work is described by Hayes (2001) as a ‘relatively new and dynamic research area’ and a research stream to which this thesis wishes to add.

2.4.1 HOW KNOWLEDGE WORK IS DIFFERENT

Scarborough (1999) criticises the use of the term ‘knowledge worker’ as lacking both methodological and theoretical rigour, preferring to define knowledge worker in terms of the work that they perform. What must a person possess to be called a ‘knowledge worker’? Though it is difficult to place knowledge-workers and those who are not into specific categories as the concept of ‘knowledge-intensiveness’ is vague even so it still ‘makes sense’ to refer to knowledge intensive companies as a ‘vague but meaningful category’ as in many ‘crucial respects’ there exist large differences between them and firms offering a more routinised service, (Alvesson, 2000).

By its very nature knowledge work differs from either administrative or operational work, (Davenport et al., 1996). Knowledge workers can be defined in terms of the work that they perform: work which is ‘relatively unstructured and organizationally contingent’ and work which reflects more the changing demands of an organization rather than ‘occupationally-defined norms and practices’ (Scarborough, 1999). Knowledge work is described as being ‘untidy’ with less definite inputs and outputs (e.g. ideas and inspirations) than administrative work (Davenport et al., 1996).

A distinguishing characteristic between knowledge workers and other categories is the high level of discretion and autonomy the knowledge worker possesses, (Davenport et al., 1996). In the case of knowledge workers managers need to give up day-to-day control while dealing with strategic issues and overall direction of the firm, (Davenport et al., 1996). In the case examined by Daar (2003), responsibility was given to the knowledge workers to deliver a customized product for clients that was satisfactory, on time and was profitable. In addition the firms' knowledge workers joined their clients work teams and so were monitored by their clients' workers. The product, a computerized tester, was an emergent technology and provided 'interpretive flexibility' meaning that there were different interpretations of the 'artefact' among the groups involved with its design and use being negotiated to meet the needs of the client, (Daar, 2003). The main groups of knowledge workers examined by Hayes (2001) were salespeople in the pharmaceutical industry, dealing with complex sales to medical groups and endowed with 'considerable autonomy' about how they organized their work within their region: another group considered were the medical group that conducted clinical trials and the marketing function where sales material was gathered and market analyses undertaken.

In some medical contexts a large proportion of the knowledge only exists in an 'oral and distributed form', (Ellingsen, 2002). A particular physical location was the 'on-duty room' where doctors and nurses could ask questions, coordinate their activities and discuss their cases and so produce and reproduce knowledge through a collective process within a community, (Ellingsen, 2002).

2.5 ATTRIBUTES OF KNOWLEDGE WORKERS

Having argued that knowledge work is different this section will examine what attributes a knowledge worker should possess. These will be used to identify a suitable case company for the research study.

2.5.1 KNOWLEDGE WORKER OR PROFESSIONAL?

Professionals are expected to possess particular expertise, (Kakihara and Sorensen, 2002) and are experts through the acquisition of a knowledge-base over an extended period of

time Von Glinow 1988 quoted in Lee & Maurer 1997). However Scarborough (1999) distinguishes between professionals and knowledge workers on the basis that professionals 'work from knowledge' while knowledge workers 'work with knowledge'. The knowledge that knowledge workers work 'with' being not only their own knowledge but also that of other knowledge workers that is communicated to them via information technologies and artefacts, they also work with 'organizational and technical knowledge' which is embodied in programs, routines and also management discourse, (Scarborough, 1999).

Defining knowledge workers as working 'with' knowledge has a number of implications, (Scarborough, 1999). There is less opportunity for knowledge workers to gain power by monopolizing specialist knowledge. Knowledge workers have a different relationship with the knowledge that they create and apply than other professionals. While other professionals are involved in the application of 'predefined expertise', knowledge workers by contrast are involved in "*a joint product of human interactions with informational and intellectual assets*" which are often delivered via ICTs, so making them more reliant on their employers, (Scarborough, 1999).

Professional intellect partly involves cognitive knowledge: (know-what) achieved through training and certification and showing mastery of a discipline as well as systems understanding (know why) an understanding of the cause and affect relationships present in a discipline which enables bigger and more complex problems to be solved and create immense value, (Quinn et al., 1996). Knowledge workers may possess content knowledge, (Tissen et al., 2000) which may be highly specialized and state of the art knowledge, (Ellingsen, 2002) requiring high levels of education. However, rather than being a central asset of professional service firms the professionals' technical expertise is instead merely a necessary precondition, (Liedtka et al., 1997). (Tissen et al., 2000:161) take a different view arguing that specialized knowledge is not a prerequisite for a professional as it can be "*insourced from external specialists*". Breadth as well as depth of knowledge may be required, as a coordination mechanism as well as facilitating communication. Partners in professional services firms were not only experts in their own field but also generalists as they were aware of the capabilities of the other partners and had 'T-shaped' skills: expertise in one area coupled with the ability to 'link' their work to other areas, (Liedtka et al., 1997).

2.5.2 COMPETENCIES

Firm value is generated through employee competence, composed of not only knowledge but the ability to apply that knowledge, (Roos et al., 1997). The competencies required by knowledge professionals which enable them to work with knowledge are social competencies as well as the ability to think and the ability to learn from information, (Tissen et al., 2000). In innovative firms there is a need to move from a rationalistic view of formalized competence descriptions to a more complex conceptualisation of 'competence-in-action', including personal interest, which are emergent and dynamic and should increase motivation, (Lowendahl and Haanes, 1997).

2.5.3 INTELLECTUAL ABILITY

This places the ability to think as a core capability. A distinction is drawn by Roos et al. (1997) between what they term 'competence' which is content (knowledge and practical experiential skills) and intellectual ability which involves the use of that competence. Professionals have to be able to continuously think about how to apply their know-how to current business issues, (Tissen et al., 2000). Knowledge professionals ability to think involves three competencies: (a) analytical; the ability to use logic which is a rational approach, (b) creativity, the ability to think laterally, an emotional approach; and (c) reflexivity, the ability to consider lessons learnt, developing 'self-reflection', (Tissen et al., 2000).

2.5.4 CAPACITY TO ACT

Massey & Clapper (1995) argue, with reference to (Cartwright, 1973, Volkema, 1983, Volkema, 1988) that as the number of variables or elements of a problem increase specificity and measurability decrease, a problem becomes more complex and ill structured. Knowledge workers must possess competencies capable of dealing with problems and opportunities that are semi-structured or unstructured, (Tissen et al., 2000) and so must have the capacity to act in a wide variety of situations (Sveiby, 1997). This can be achieved through being able to apply the content knowledge to semi/unstructured situations. This application of knowledge in different situations is labelled 'intellectual

ability' by Roos et al. (1997:39) who define it as "*the ability to transfer knowledge from one context to another, the ability to see common factors in two distinct pieces of information and link them together, and the ability to improve both knowledge and company output through innovation and adaptation*". This ability is referred to as know-how: the application of knowledge to a specific situation (Quinn et al., 1996) is seen as an advanced skill and the most important level of professional intellect after motivation.

Knowledge professionals should be capable of thinking for themselves, (Tissen et al., 2000) with expertise being exemplified as not the ability to know and apply rules but by the confidence an individual has in breaking and replacing rules with those that are better, (Sveiby, 1997).

2.5.5 SOCIAL

Knowledge workers need to have human competencies, (Tissen et al., 2000). Professional service firms, during recruitment, took analytical ability as a given, and stressed the need for other competencies such as interpersonal skills which included qualities of integrity and respect for the opinions of others, in order to develop a 'team consciousness', (Liedtka et al., 1997). The three social competencies outlined by Tissen et al. (2000) involve: (a) team-working which helps in the development of competencies in collaboration and knowledge-sharing; (b) dialoguing- listening to arguments without imposing preconceptions and finally (c) networking, which helps in the location of information. In the case of networking Sveiby (1997) argues that professional competence is tied to an independent network outside the organisation and that managerial competence is also heavily reliant on a social network.

The ability to collaborate is important for knowledge workers. Collaboration involves informal professional networks outside the firm as well as contacts with customers, (Sveiby, 1997). As Liedtka et al. (1997) found, the qualities that enable collaboration in the long run were sought by professional services firms at the recruitment stage.

2.5.6 LEARNING

A vital quality for partners in professional service firms was their ability to continue growing and learning, (Liedtka et al., 1997). Knowledge professionals need to be able to learn from information which can be achieved using three competencies: sourcing involving knowing where to look and how to locate particular information; questioning, concerning knowing what questions to ask and answering them through turning data into information; and sensing which required having an open mind and postponing judgement while information is gathered (Tissen et al., 2000).

2.5.7 OTHER CATEGORIES

Other competencies attributed to knowledge professionals include: being innovative and creative, as well as the ability to add value (Tissen et al., 2000) and having entrepreneurial instincts which involve the possession of a mind that was seen as inquisitive and energetic as well as the ability to identify an opportunity, (Liedtka et al., 1997). The types of competencies required, in the case of professional services firms, were similar for new recruits and partners though their relative importance changed over time from technical expertise in former stages to increasing emphasis on interpersonal and entrepreneurial abilities at partner level, (Liedtka et al., 1997) .

2.5.8 SELF IDENTITY

When it comes to determining appropriate codes of behaviour, professions tend to look to their profession (Quinn et al., 1996), and have a tendency to surround themselves with those having similar values and backgrounds, which can result in resistance to change and detachment from customers.

2.5.9 MOTIVATION

Motivation is crucial from a structural perspective as it links conceptually the rationalisation of action at the individual level with frameworks of conventions embodied in institutions, (Giddens, 1979). The most important component of professional intellect

according to Quinn et al. (1996) is self motivated creativity consisting of will, motivation and the ability to adapt for success: without this a knowledge-advantage may be lost through complacency.

Knowledge workers are prepared to work long hours, (Alvesson, 2000) are committed, hard-working, the “ultimate in motivation and performance” (Tissen et al., 2000) and due to their motivation level and compliance they make the ‘ideal subordinates’ (Alvesson, 2000). While knowledge intensive firms give a high degree of importance to the motivation of their professionals, most of the motivational theories were designed for an industrial economy rather than a knowledge one, (Tissen et al., 2000).

Because they are a minority and being possessed of high mobility knowledge workers will be able to command high remuneration, (Drucker, 1993). They are motivated by an equitable share of the profits (Tissen et al., 2000). Their motivation is not just predicated upon financial rewards but also on particular work norms or because of the identity they have developed about what it means to be a knowledge worker, (Alvesson, 2000). Motivation is also emotionally and intellectually based with professionals feeling a ‘deep sense of engagement’ to the firm and partners feeling a ‘passionate commitment’ to their colleagues (Liedtka et al., 1997).

An important motivational factor for knowledge workers is an interest in the content of the work (Alvesson, 2000) which challenges them, providing a form of self-expression (Tissen et al., 2000) and from which they derive pleasure (Liedtka et al., 1997). Professionals who enjoy the work itself are more willing to become involved in creative conversations about the work with others, (Liedtka et al., 1997). Indeed another motivational factor may be the other individuals with whom they will get to work, though in order to derive pleasure from working with others the knowledge worker needs to feel there is a balance between what they contribute and what they receive (Tissen et al., 2000).

Knowledge workers are also motivated to develop their own careers, (Tissen et al., 2000). Three types of engineer were identified (Allen and Katz, 1986, Allen and Katz, 1995) based on their motivation: there were those interested in specific projects making them ‘nomadic’, those more committed to professional norms and ethics of the profession than

of the firm and finally those who were attracted to a career in management. Job security and the possibility of promotion to the highest possible level were identified as key motivators to employees in a Japanese bank (Kubo et al., 2001).

It is argued that ‘knowledge work, by its very nature, seems to defy measurement’, (Lind and Sulek, 2000:1154) due to the intangible nature of the output, and control by knowledge workers of the timings of their tasks: however in the case of the re-use of existing knowledge they argue objectives are clearer.

2.6 CONCLUSION

This chapter outlined the traditional knowledge-as-object view of knowledge management. The criticisms of this perspective outlined in section 2.3 argue for a differing epistemological stance: that knowledge cannot exist as separate from those that create it. These criticisms led to the development of the second perspective on knowledge management-the practice-based view. Having outlined views on the knowledge worker including the attribute ascribed to them and how the work they do is different in sections 2.4 and 2.5 the thesis, in chapter 3, explores this second view on knowledge management, the practice-based perspective.

3 THE PRACTICE BASED PERSPECTIVE OF KNOWLEDGE MANAGEMENT

This chapter examines the second view on knowledge management: the practice-based perspective. The first, the knowledge-as-object view, was discussed in chapter 2. Structuration Theory provides key concepts within this literature stream and examine key tenets of this theory. The first sub-section 3.1 reviews the types of phenomena that have been investigated by this research stream while sub-section 3.2 considers agency. Because Structuration Theory takes the position that individuals are reflexive knowledgeable agents which, given the previous chapter, is suitable for examining knowledge workers. Having looked at a micro-level at individuals the next sub-section 3.3 moves to the macro-level of how structures are constituted. Structuration theory conceptualises agency and structure as a duality, mutually constituting each other. The previous concepts of agency and structure are theoretically linked by what are termed the ‘modalities of structuration’ in sub-section 3.4 which include two types of rules, relating to shared meanings and norms, as well as resources.

In sub-section 3.5 consideration is given to a particular research stream that applies Structuration Theory to analyse organisational communicative mechanisms (genres) by examining how each of the three modalities covered in the previous sub-section were applied. This research stream is useful during chapter 7 when analysing how solutions are documented by knowledge workers.

Though modalities theoretically link agency and structure, and through they can be analysed in isolation they are in reality intimately interconnected as agents enact and re-enact practices, which are discussed in sub-section 3.6. When practices are re-enacted in the same ways consistently over time they create structures (or more correctly structuring properties). The final section of this chapter examines how the practice-based perspective has been used in the knowledge management literature.

More research using a practice-based perspective is important because it is argued that what is needed is an examination of ‘rich full-blooded’ practices and activities rather than canonical abstractions, (Brown and Duguid, 1991) with Orlikowski (2002a) making the point that little research has been carried out to consider the process of knowing in organizations that are complex and geographically dispersed. Neither perspective-making or perspective-making are adequately considered in the design of communication systems, (Boland and Tenkasi, 1995).

3.1 PHENOMENA INVESTIGATED:

Structuration theory has been used to overcome confusion and contradictory research, (Barley, 1986) as well as to avoid viewing communicative media as either a dependent or alternatively a mediating/independent variable, (Yates and Orlikowski, 1992). Initially technology was introduced as a mediating variable within the duality of structure concept Orlikowski (1992) to overcome the subject-object duality within the information systems domain, Orlikowski and Robey (1991) who extended the structurational model to include the modalities of structuration.

Structuration theory has been used to examine a number of issues in the area of information systems. The norms and meanings of systems developers and users as well as the interpretative flexibility of a technology as a social construct, (Orlikowski, 1992). Communications systems have been examined, Yates and Orlikowski (1992) as well as system building methodologies, Orlikowski (1993) and technology as a trigger for change, (Orlikowski and Gash, 1994, Tyre and Orlikowski, 1993, Tyre and Orlikowski, 1994). While Orlikowski and Gash (1994) saw a ‘window’ for change during implementation Orlikowski (1996) viewed resultant organizational transformation as emergent rather than sudden.

One stream of structurational research has focused on the structuring properties of communicative genres. The ‘substance’ of a genre involve the concepts to be communicated and its social motive whereas its ‘form’ involves physical and linguistic features including; structural features (formatting), communication media and symbol system (specialised vocabulary) (Yates and Orlikowski, 1992). Genres and sub-genres

may exist at a number of levels, culturally, intra- and inter-organizationally or at a group, but not an individual level, (Yates and Orlikowski, 1992). Layers of communicative interaction were found by (Woerner et al., 2004). The process of genre structuring was found to be influenced by: the various communities existing genre repertoire, tasks at hand, users prior institutional experiences, rules and actions (if any) of mediators, the context and history of the community, the new medium and its capabilities, and did not just occur at the time of the initial implementation but happened through everyday communicative actions, (Yates et al., 1999).

3.2 AGENCY

Agency involves the intervention into a potentially malleable object-world accruing as a continuous flow of conduct rather than as a number of discrete acts, Giddens (1979), it being possible to take these ‘discrete segments of action’ from the continuous flow so as to categorise and describe them, (Thompson, 1989). Rather than viewing people as ‘cultural dopes’ as in functionalism Giddens conceptualises agents as possessing practical and discursive knowledge about the social world and the structures within which they interact, (Borg, 1999). Action requires power, seen as the capacity to transform, Giddens (1984) with resources the media, through which power is exercised, (Outhwaite, 1990a). At any time agents are capable of ‘acting otherwise’, thus exercising power by influencing others or specific processes, (Giddens, 1984). Accepting power as elemental allows Giddens to insist interchanges are likely to be skewed by the societal distribution of power, (Kilminster, 1991).

The actors that are examined in the various studies in the structural perspective change as the technologies developed change. Initially actors were seen as developers, drawing on structures to programme knowledge and assumptions into information systems, or users appropriating these embedded rules as well as potentially modifying their use to create new practices, (Orlikowski and Robey, 1991). Information technology, while only given meaning through human action, both constrains and enables it, (Orlikowski, 1992). Where more structured systems, and system building methodologies such as CASE are examined in the early 1990’s then actors were categorised into designers and users, analytically separate because of temporal separation in the design and use phases.

In later studies, involving technologies such as e-mail, news systems, and PowerPoint presentation software it is system use that is examined because of the technologies inherent interpretative flexibility through use users may, (within the constraining properties of the technology as stabilized for now, though capable of change by designers), partially redesign (more correctly restructure) the technology through their use. In this way users of PowerPoint may not add/modify system capabilities but may use the technology so that it structures their actions and interactions differently: from use as a replacement for acetates to partially replacing the written report genre (Yates and Orlikowski, 2007). In some cases such as Orlikowski (1996) a structured database technology (in a support centre) changed work patterns while also involving designers to modify the system capabilities. Actors are seen by Orlikowski et al. (1995a) in similar terms to Orlikowski (1992) but the latter model incorporated technological frames (interpretative schemes) via technological use. Orlikowski et al. (1995a) augments the structurational model so that actors can have the ability to influence others actions by influencing others' technological frames through 'technology-use-mediation'. Actors, by affecting others technological frames may thus affect the latter's' behaviour, (Orlikowski et al., 1995a).

A theory of action and structural analysis is possible through the use of regularised practices rather than discrete acts, (Giddens, 1979). The practices are 'recursive' whereby human activities are continually recreated through actors' means of expression thus reproducing the conditions that make action possible, (Giddens, 1984). The continuity of social practices presumes agents are reflexive, this reflexivity necessitating social practices as distinctly 'the same' over space and time, (Giddens, 1984). Reflexivity involves actors continual monitoring of actions: their own, including self-regulation, others actions, as well as physical and social contexts of interaction, along with their knowledge of the mechanisms for system reproduction, resulting in feedback into the system they reproduce, (Giddens, 1984).

Another prerequisite for agency is actors' knowledgeableability, defined as involving all they know regarding the circumstances surrounding they own and others' actions, held in actors' minds through practical and discursive consciousness and drawn upon to produce and reproduce actions, (Giddens, 1984). Giddens (1979) outlines three qualifications to knowledgeableability: that even discursive knowledge may not be expressed in a propositional

way; that it is historically and spatially located, shading off in other contexts; and is circumscribed in ways connected, but not reducible, to actors' situated activities.

Actors' technological frames (involving assumptions, knowledge, expectations and purpose) may affect their interaction with a technology with actors influencing/being influenced by their organizational context, (Orlikowski, 1993). Actors reflexivity can result in their examining possible modifications of a technology Tyre & Orlikowski (1994) as well as considering intentional changes they wish to achieve through the IS (Orlikowski, 1993). Reflexivity may be temporally bounded, actors' modification to a technology resulting in routines that, once established crystallized, becoming difficult to change without an event or discontinuity, (Tyre and Orlikowski, 1994).

A number of authors criticise Giddens conceptualisations of agency. While Kilminster (1991) agrees that by stressing actors knowledgability and reflexive monitoring structuration moves towards subjectivism. Outhwaite (1990a) goes further in arguing that individual and collective activity are given a 'privileged position'. Giddens view of agency involves a normative judgement that the individual should be maximised, providing an exaggerated view of the skilled agent: this lead to a view of the agent as rational, at the expense of the irrational and unconscious, though this criticism is qualified when he points out that Giddens concentration is on 'pacified nation states' where the unconscious is not as implicated in everyday action, (Kilminster, 1991). However, in the cases of businesses Groth (1999) argues that significant members can be of decisive importance to organizational outcomes.

Actors can rationalise their actions, even to the extent of lying, but what is found to be interesting is the 'grey area' of mutual knowledge not discursively available but involving practical knowledge but inherent to the ability to 'go on' with routines, (Giddens, 1979, Giddens, 1984). Reflexive monitoring and rationalization of actions involve reasons held by actors, offered to explain their actions, while the actions themselves are prompted by the actors' motives and wants, (Giddens, 1984, Thompson, 1989).

Intentions and reasons for acting can be discursively explained by the actor while motivation - the organization of an actors' wants Giddens (1979) provide plans or the potential for action, occurring at the level of practical consciousness (Giddens, 1984). The motivational components of action 'straddle conscious and unconscious' Giddens (1979) so that discursive explanation may not be possible.

Giddens (1979) argues that the majority of elements of social practices are not directly motivated with 'motivational commitment' involving a general integration of habitual practices produced by interactions which are reflexively monitored by agents with personality acting as a 'basic security system'. Social practices possess a normative character as the reactions of each interacting party depends on others contingent responses which provide a potential sanction on the first persons acts and vice-versa, (Giddens, 1979). Social reproduction involves change in its 'very contingency'- change or the potential for change is inherent within every moment that social reproduction occurs, with every change having implications for the totality involving, however trivial, the modification of structures, (Giddens, 1979).

Individual actions and behaviours can be motivated by wishing to maintain a consistent self image, Thompson (2004) which is based on social norms, so that actors may try to redefine an organization, where the two are incongruent, in terms of their identities (Mantovani and Spagnolli, 2001).

3.2.1 KNOWLEDGABILITY OF ACTORS

The mutual constitution of practice and knowing are a key premise of structuration theory, (Orlikowski, 2002a). It is a 'leading theorem' of structuration theory that social actors are knowledgeable regarding the conditions that reproduce the society that they inhabit Giddens (1979), so that knowledgeability is inherent in social life through being incorporated within the practical activities that compose actors daily lives, (Giddens, 1984). Actors have to be knowledgeable about the structural framework within which they act, as, in acting they draw upon this very framework to produce their actions (while reconstituting the framework through their actions), (Giddens, 1979). The social world that actors inhabit cannot be separated from what the actors know about the social world:

thus it is unlike the natural world where separation between knowledge of events and objects in nature can be achieved, (Giddens, 1984).

Because actors reflexively monitor the flow of social life: their own and others' actions this knowledgeability affects how they recursively order their social practices, (Giddens, 1984). According to Haugaard (1991) knowledgeability of the social world is a manifestation of agents continuous monitoring of their actions with the knowledge involved being 'stored' in discursive and practical consciousness. Structures are 'carried' in the knowledge (discursive and practical) held by actors and thus can exist outside of the moment of action, (Haugaard, 1991). The practice-based perspective highlights the centrality of human action in accomplishing complex work in organizations, (Orlikowski, 2002a). Competence generation is seen by Orlikowski (2002a) as a process of developing individuals capacity to enact what can be called 'useful practices'.

While Giddens (1979) accepts that knowledge exists at an unconscious level he believes that the differences between what he terms 'practical' and 'discursive' consciousness are more significant, later arguing that knowledge must be understood in terms of the latter two forms of consciousness, (Giddens, 1979). The knowledge held at the practical and discursive levels allows a view of the individual as 'cognitive intentional actor at centre stage', (Haugaard, 1991).

Practical consciousness involves the tacit knowledge which actors draw upon during social activity and is embedded in what individuals 'know how to do', (Giddens, 1979). Enabling them to 'go-on' through the use of the social rules and conventions, Giddens & Pierson (1998) and is neither shallow or inherently trivial, (Haugaard, 1991). Practical consciousness as a concept links the knowledgeability of actors with the structural features of social systems, (Giddens and Pierson, 1998). Structure can only exist where agents act knowledgeably within a particular context and where these actions have particular consequences, (Giddens and Pierson, 1998).

Knowledge which actors can express and speak about as well as the manner in which they are able to talk about is discursive consciousness, (Giddens, 1979). Agents are always able to provide some explicit description as they know what they are doing at a discursive consciousness level even if they may not be aware of the ramified consequences of their

actions (Giddens, 1984). All actors have some ‘discursive penetration’ to the social systems to which they contribute, (Giddens, 1979). According to structuration theory there can be no circumstances when the conditions of actions are completely ‘opaque’ from actors as actions are ‘constituted’ through the ‘accountability of practices’, (Giddens, 1979).

Orlikowski’s (2002b) perspective concentrates on the ‘knowledgeability of action’ and on a verb ‘knowing’ rather than a noun ‘knowledge’. She indicates that a move from knowledge to knowing has important conceptual implications and quotes Schon (1983:49) that “our knowing is in our action” and that professionals skilful actions are not from the application of previously learnt knowledge but rather are inherent in their actions. Seely-Brown & Duguid (1998) argue that there are capabilities, such as knowing how to use knowledge in practice that are embedded in a community of practice. These can move among similar communities of practice but are ‘sticky’ and is hard to move across communities. The process of knowing involves action and a capability to ‘perform or act in particular circumstances’ and this knowing-how can be identified by observation of the practice, however, “*the practice has no meaning apart from the ‘knowing-how’ that constitutes it*”, (Orlikowski, 2002a:251). Therefore actors are assumed to be knowledgeable: they are competent and capable of enacting practices in particular situations to accomplish tasks. Giddens (1979:5-6) refers to Wittgenstein in stating that “*to know a form of life is to be able in principle to participate in it.*” (Orlikowski, 2002a: 250) views knowledge as:

“at any given time, what the practice has made it” and sees knowledge as “enacted- every day and over time- in people’s practices. It [this view of knowledge] leads to understand knowledge and practice as reciprocally constitutive, so that it does not make sense to talk about either knowledge or practice without the other.”

3.2.2 WORK ATTRIBUTES

The abstractions of work may fail to cope with the complexity of the practices from which the abstractions were developed: examples of abstractions being documented work processes, (Brown and Duguid, 1991). A problem with documents is that they outline what to do rather than why, Brown & Duguid (1991) refer to as canonical practices.

Schultz (2000) takes a practice orientation: concentrating on what 'is' done rather than what ought to be done or what workers say they do. Even workers may describe their jobs in canonical terms but yet perform them in non-canonical ways- this being due to the privileging of abstract knowledge, (Brown and Duguid, 1991).

Rationalistic approaches to work define competence in terms of context-independent attributes with work described in narrow terms which fails to embody the 'complexity of competence' and provides the researchers rather than the worker view of work while ignoring the ability of workers possessing identical attributes to accomplish work differently, (Sandberg, 2000).

The rules and routines involved in knowledge work are unstructured and 'individualized' and given the high degree of freedom knowledge workers possess then a problem with approaching knowledge work as a process is that such a process view would require some 'commonality of activities', (Davenport et al., 1996). While Tissen, Andriessen et al. (2000) define routine as highly repetitive or predictable activities, arguing that even the most intelligent work is routine under this definition if a discernable pattern can be found. Their view of 'routine' seems to be more deterministic. Tsoukas (1996) argues quoting (Gadamar, 1980) (p83) that '*the application of rules cannot be done by rules*' so that an agent's understanding exists primarily in the practice that they participate in so that the locus of the individuals 'knowing how' to follow a rule is implicit in the activity and practice within which they engage. Through interaction with their part of the firms environment and their network of practice communities develop 'local solutions' to problems, (Brown and Duguid, 2001).

3.2.3 ACTORS KNOWLEDGABILITY BOUNDED BY CONTEXT SPECIFICITY

"there is something elusive about social practices, no matter how replete with similarities they may be: at any point in time, one cannot offer a comprehensive description of a social practice, since to do so presumes first that one is able to foresee all future events that may occur in a practice, and secondly, that one possesses an unambiguous language which can faithfully reflect what is going on", (Tsoukas, 1996: 18).

Practices can involve high levels of improvisation and can be highly context specific, (Brown and Duguid, 1991). Giddens (1984) points out that knowledge is contextually bounded- so that the rules and tactics used in practices may be different in contexts different from their expression. Knowledgeability is temporally and spatially located and the actors competency ‘shades off’ where contexts stretch beyond their day-to-day activities, (Giddens, 1979). Practical consciousness involves knowing both the rule and tactics through which life is constituted and reconstituted over both space and time, (Giddens, 1984). Where actors are incorrect as to the relevant rules and tactics then ‘situational improprieties’ can occur, (Giddens, 1984). For there to be a ‘continuity’ in social life actors must be correct (as to the rules and tactics to be used) the majority of the time- this involves knowing what they are doing and having the ability to communicate their knowledge to others, (Giddens, 1984).

The practice approach ensures that the tacit knowledge component of work is examined and from this perspective knowledge can only be understood when related to the context within which it was generated, (Samiotis and Poulymenakou, 2002). Knowing how to perform practices “*emerge from the situated and ongoing interrelationships of context (time and place), activity stream, agency (intentions, actions), and structure (normative, authoritative, interpretive)*”, (Orlikowski, 2002b: 253).

3.2.4 PERSPECTIVE MAKING AND TAKING

Sense-Making is required for dissemination and diffusion of knowledge, (Gorelick and April, 2004). A consequence of viewing knowing as an enacted practice is that competence cannot be seen as a transferable object, and by defining practices as ‘situated recurrent activities of human agents’ practices, equally, are not static transferable entities, (Orlikowski, 2000). It is argued that ‘sticky’ knowledge, that is difficult to transfer, and ‘leaky’ knowledge, prone to involuntary inter-firm transfer, because the same knowledge can be both simultaneously: rather the determining factor for knowledge transfer are the existence of common shared practices which delineate the extent of knowledge transfer, (Brown and Duguid, 2001). In discussing shared practices Brown and Duguid (2001) draw on (Giddens, 1990). They apply his concepts of embedding and disembedding conditions for transfer across communities rather than over distance. Here communication involves

the disembedding of knowledge, its communication, and subsequent 'reembedding' elsewhere. The critical issue is the degree of similarity between the embedding and disembedding conditions, which where different, may lead to a breakdown in communication and coordination.

Weick (1985) describes "consolidating" whereby actors learn about events when they have the ability to put them into context: he argues that one must look beyond particular "bit's and pieces" to group their meaning by consolidating them into a sensible and compact patterns. Consolidation is important in instances where the "pieces" themselves provide a limited context which is not adequate to understand how to change the particular "system" not enabling an understanding of its limitations.

Sense-Making is built on embedded attention structures which allow people to modify information technology to make it meaningful and sensible for their organization: these attention structures may be both enabling and restricting, (Henfridsson, 2000). Weick (1985) argues that the representation of events may suffer from a loss of meaning when occurring electronically for two reasons: firstly, the data used in electronic representations is flawed because it only contains what can be collected and processed in machines, ignoring 'context'; secondly, those managing the data have limited processing capacity.

Dickey, Burnett et al.(2007) outline the underlying assumptions of perspective theory: firstly, perspective-making or perspective-taking is the cognitive process involving skills that can be learned; secondly, perspectives are dynamic, tentative and probabilistic and open to a revision; thirdly, perspectives are social as they partially result in feedback from others and originate in interaction; fourthly, for successful communication to occur it is necessary that at least one party is able to take the perspective of the other. To engage in knowledge work a community of knowing must engage in perspective-making involving the narration of experiences through reflexive monitoring and rationalization of conduct which may necessitate space from the wider organization to refine a communities values, accepted logics, theories and vocabularies through language and actions, as well as through communicating with other communities, refinement may require complexification that enriches and refines a perspective through the creation of numerous and subtle categories and distinctions, developing 'more precise causal laws' and 'finer language games', (Boland and Tenkasi, 1995).

Hales (2007) examined “sense-making” by first-line managers and found that a structural conditions that shape how the first-line manager role is defined through meaning construction that shapes how the role is interpreted. In Hales (2007) role ambiguity allowed frontline managers to negotiate an interpretation of their role via sense-making.

One element of sense-making found by Manninen (1995) was ‘typification’- enabling the accountant to see new events as representative of familiar categories so they could be treated in a similar way to the familiar. Sense-making results in developing and strengthening of the community of knowing’s knowledge domain and practices which makes them more esoteric and precise for a particular situation, (Boland and Tenkasi, 1995). Central to sense-making is the idea that ‘meaning is not discovered or revealed-meaning is constructed by the sense-maker’ (Christiansen, 2006:503).

The modalities of structuration are influenced by individual and group sense-making, (Bloor and Dawson, 1994). Inputs to sense-making Louis (1980) are: past experiences with similar situations and surprises; and employees interpretive schemes of ‘context specific dictionaries’ which structure routines; as well as the information and interactions with others in the sense-making process. When surprises occur the insider, as opposed to the novice, has both sufficient history to interpret the surprise more accurately as well as access to other insiders with whom they can compare perceptions and interpretations, (Louis, 1980).

Storytelling was found to be central to marketing managers sense-making process, Ardley (2006) who categorised such stories into preface, backdrop, confrontation, settlement and epilogue. Massey and Clapper (1995) see sense-making as encapsulated in the intelligence phase of decision-making (Simon, 1960). The third and final stage of sense-making- “formulation” is most relevant for employees as they must generate alternative problem definitions (divergence), and, based on the available information converge to a solution. Therefore employees have little input in problem identification because all relevant information is recorded. This facilitates the structuring activity. As Massey and Clapper (1995) outlined the structuring confirmation stages can be iterative. Experience and search, enabling reading of other solutions, can be useful in divergent thinking to generate typologies with cognitive frameworks helping support the convergent definition phase.

As well as outlining the sense-making phase Massey and Clapper (1995) also discuss an 'action' making phase, particularly important given the focus of knowledge management on action. They defined part of 'action making' - idea finding- generating alternative solutions, the next stage being to evaluate the generated solutions.

Sense-Making involves reflection on actions, (Gorelick and April, 2004). Perspective-taking involves the ability to be reflexive so as to appreciate the perspective of either another individual or community of knowing, and begins by basing social behaviour on assumptions regarding the motives, beliefs and knowledge of others so that their thought worlds' are made visible and available for incorporation, (Boland and Tenkasi, 1995). Problem formulation involves identifying and exploring the available information and relationships between variables so as to identify the problem Massey and Clapper (1995) quoting (Abualsamh et al., 1990, Pitz et al., 1980, Ackoff, 1974). This may result in old rules, meanings, acts and perceptions being changed or replaced by 'renarrativising' them to find new insights and opportunities, (Boland and Tenkasi, 1995). Gorelick and April (2004) argue that sense-making is an output of memory and meaning systems, represented by the language and symbols, has the objective of accomplishing 'pattern maintenance'. Morgeson (2005) found managers constantly scanning the environment for potential disruptions to current perspectives so as to decide if intervention in self managing teams was necessary. Coopley, Keegan et al.(1997) found managers could exhibit agency, and were on a 'light rein' with the ability to manipulate their roles (Katz and Kahn, 1966, Fondas and Stewart, 1994). Though Coopley, Keegan et al.(1997) found managers could exhibit agency in undermining procedures to progress projects if they felt the situation demanded.

Gorelick and April (2004) quote Feldman (1989) in viewing sense-making as requiring organizational members to understand features of the organization such as what it does, the problems faced, and how they could be resolved. For the information processing model of human cognition meanings are not problematic while the language game model (being social constructionist) viewing words only as taking on meanings through actual use within a community with meanings being 'symbolic and inherently ambiguous', (Boland and Tenkasi, 1995). Reality testing is an important impact to sense-making as it is important that novices have access to insiders to help assign meanings to events, (Louis, 1980).

Boland and Tenkasi (1995) outline the key assumptions underlying the language game model and narrative mode of cognition. Knowledge and the methods for its realization are seen as objective only to the extent that a community ratifies them as objective via their interpretive conventions. It is within the context of a community of knowing that a consensus can exist regarding the meaning of words, though this meaning can change over time and space. Language is both thought and knowledge and so the limitations on language limits knowledge. Language is not representational of an underlying knowledge which is objective. New knowledge is created when ‘renarrativising’ the familiar or through developing narratives to explain the unfamiliar and may involve inventing new language and forms of narrative, (Boland and Tenkasi, 1995). Where a community possesses a perspective that is developed then it has well established ways of ‘externalizing its objects’ (Boland and Tenkasi, 1995).

Cramer, Heijden et al. (2006) found change agents initially engaged in sense-making due to uncertainty (about the concept) and in applying the concept to their own organization the various resultant possibilities required sense-making to clarify the ambiguity that arose. Dickey, Burnett et al.(2007) found that difficulties arose in customer service representative chat sessions where the intended meaning of text was misunderstood as well as this Customer Service Representatives were unable to engage in interactive questioning, being a limited to predefined and codified texts in a balance between empowerment over tight control in the balance.

The objective of perspective-making is to induce the perspective in someone else (Graumann, 1989). Dickey, Burnett et al.(2007) also refer to as perspective setting or perspective giving. Perspective-taking involves taking others point of view and assessing what they know Krauss, Fussell et al.(1995)- but the assessors prior views of what the other knows may change during interaction.

Boland & Tenkasi (1995:352) argue that it is through perspective-taking and perspective-making that communities of knowing are transformed and this is the “*basis for open system control in knowledge work*”. Because ‘interstitial communities’ possess a practical as opposed to a formal connection to the world their ‘actual noncanonical practices’ continually develop new interpretations of the world, (Brown and Duguid, 1991).

Change, in the knowing-in-practice perspective come about from internal and external factors, (Boland and Tenkasi, 1995). Change come about from inside the knowing-in-practice-perspective due to the ‘accumulation of anomalies’ , (Boland and Tenkasi (1995). External change come about in communities of knowing as members begin to adhere to new (external) perspectives, (Boland and Tenkasi, 1995).

Referring to Orr’s research of non-canonical practices resulted in the development of concepts such as ‘narration’, ‘collaboration’, and ‘social construction’, (Brown and Duguid, 1991). ‘Narration’ involve the use of stories by specialists to develop coherence around a problem- helping them develop causal accounts, (Brown and Duguid, 1991). Stories may become ‘repositories of accumulated wisdom’ with story-telling preserving knowledge so that it can be used again, (Brown and Duguid, 1991). Problem solving by specialists can involve non-canonical practices such as storytelling as a method of moving from ‘incoherence to coherence’, (Brown and Duguid, 1991) .

3.2.5 LEARNING

Brown and Duguid (1991) argue that learning is inseparable from working and where work is collective so too is learning with the insights generated through collaborative work being socially constructed and distributed. Learning is seen as occurring within a context that gives it meaning, therefore, rather than seeing learning as the transfer of abstract knowledge Brown and Duguid (1991) view it as occurring where, by learning the practices and taking the subjective community perspective with its language, a person becomes able to behave like a member: the central point is not to learn about practice but to become a practitioner. Those who cannot acquire implicit practices may become isolated while those whose understanding develops may legitimately move from a communities periphery, (Brown and Duguid, 1991). A negative of the knowing-how to learn was that this learning was lost to the firm where the employee leaves, (Orlikowski, 2002a).

In sharing practices within a community know-how and tacit knowledge are also shared so that a communal practice is created, (Brown and Duguid, 2001). It is possible to transfer knowledge readily in communities which have developed a shared perspective with common practices, and thus have similar embedding circumstances enabling the effective

transfer of explicit knowledge, (Brown and Duguid, 2001). Where knowledge is new or emerging it is difficult to transfer to other communities until the underlying practices become common: as individuals move they may bring practices rather than knowledge with them, acting as informal boundary spanners, becoming more important than formal methods while requiring less time and attention, (Brown and Duguid, 2001). To understand how information is constructed and transferred between different communities the distribution of power among them needs to be understood, (Brown and Duguid, 2001).

3.3 STRUCTURE

While structure is basic and essential few concepts according to Thompson (1989) are more ambiguous and contested. Sewell (1992) finds structure both impossible to do without and impossible to adequately define. For Giddens (1979) there are two elements of structure: patterns of actions between actors and groups and the continuity over time of those interactions. This ‘structuring property’ binds time and space in a social system, providing systematic form, (Giddens, 1979, Giddens, 1984). This is achieved by enabling ‘discernibly similar patterns’ Giddens (1984) of rules and resources, recursively implicated in the reproduction of social systems (Giddens, 1979, Giddens, 1984) as well as identifying sets or matrices of rule-resource properties, (Giddens, 1979). Time and space are important aspects of social practice as they exist at the intersection of moments of difference: temporal, spatial and paradigmatic, where structure is present only in its instantiation, (Giddens, 1979). By conceptualising structure as a ‘virtual order’ implies that social systems do not have structures but exhibit ‘structural properties’ as social practices are reproduced, (Giddens, 1984). Thus structure exists in the instantiation of practices and as memory traces directing knowledgeable agents, (Giddens, 1984).

Sewell (1992) argues that Giddens conceptualisation of structure is ‘underspecified’ and while though he goes further that other social scientists who leave structure undefined Giddens notion is insufficiently clear to act as a foundation to a theoretical system. Archer (1990) criticises recursion, arguing firstly that rules and resources are not as coherently organised as grammar and secondly that action need not be tightly integrated into the social system. Giddens fails to answer ‘when’ questions such as when are actors transforming and when are they trapped into replication (Archer, 1990).

Structures were seen as being inscribed in information systems, to be drawn upon by actors, Orlikowski and Robey (1991) with organizations possessing structuring properties that influenced actors' interactions with technology, and were reinforced by technology, (Orlikowski, 1992). Orlikowski (2002a) argues that to see technology as embodying specific stable structures departs from Giddens view of structures as virtual, so that 'inscribed' properties of technology should not be seen as structures but as technological elements, when mobilised, helping constitute recurrent practices that structure action- i.e. 'potential structuring elements'. The distinction between an artefact as an entity with material dimensions transcending a particular setting and use of a technology in actors' repeated non-predeterminate, yet not infinitely malleable experiences is an analytical rather than ontological distinction, Orlikowski (2000).

Orlikowski (2000) moves away from viewing structures as inscribed/embodied in technology as in the case of Orlikowski and Robey (1991) and Desanctis and Poole (1994) who consider structures as emergent, with users not enacting but rather appropriating technology through emergent recurrent and regularised interaction. Structure then exists in practices enacted through workers' actions, (Orlikowski, 2002a). While similar to Tyre and Orlikowski (1994) regarding routinised actions Orlikowski (1996) shifts emphasis regarding how practices change, from episodic change, in the case of metastructuration to sustained changes. Both types of change are considered in (Yates et al., 1999) who examine a news system where norms for use developed. Two types of structures were created explicit and implicit genre structuring, Yates, Orlikowski et al.(1999). Explicit genre structuring involves the enactment of companywide genres which were deliberately shaped by the actions of a few members, with episodic change occurring at implementation while emergent change happened in everyday actions that reinforced or changed genres, Yates, Orlikowski et al.(1999). As people enact technologies in practice they may modify the modalities of Structuration used to enact the technology, (Orlikowski, 2000).

Structures exist at a national (cultural) level Montealerge (1997) providing differing meanings in international firms resulting in conflict over IS implementation, (Walsham, 2002). External structures affecting system use include professional norms, (Hayes and Walsham, 2001). Structures existing at an organizational level have centred on legitimate behaviours and rewards Hayes and Walsham (2001), and resource/cost allocation, Karsten

(1995) with implementations legitimated with reference to a need for control Hayes and Walsham (2001), achieved through financial control systems Newell, Robertson et al.(2002), or to monitor productivity enabling a redistribution of income (Mantovani and Spagnolli, 2001). Though this risks workers viewing surveillance as the *raison d'être* for the implementation, resulting in heterogenisation of perspectives in line with the dominant group, and increasing their visibility to managers, (Hayes and Walsham, 2001). Monitoring may also be enabled between workers to facilitate cooperative work, (Karsten, 1995).

Systems were found to increase social and system integration with some consultants threatened by being increasingly bound to the firm, others enjoying the reduced isolation, (Karsten, 1995). Structures may be explicitly created by groups using usage guidelines/standards and coaching to disseminate legitimate shared meanings around technology use, though this legitimation for certain activities was later withdrawn with other activities being emphasised, (Orlikowski et al., 1995b). The existence of formal documents reduces questions of legitimacy, (Newell et al., 2001, Mantovani and Spagnolli, 2001).

Changing structures may involve a set of interactions such as a meeting Karsten (1995), group or committee as found by Orlikowski et al (1995b) and (Mantovani and Spagnolli, 2001) or through transposing rules for one technology onto another (Borg, 1999) as well as deducing new rules based on existing organizational rules, (Mantovani and Spagnolli, 2001). It was also found that the same rules could have multiple interpretations that supported opposing positions, with differing interpretations causing conflict over system functionality, (Karsten, 1995). Where reward structures were incongruent with proposed new practices (knowledge-sharing) there was little system use to achieve this practice, (Robertson et al., 2001). Actors who wished to engage in a particular practice (involving a new system) that had low legitimacy in the firm drew on more important meanings (around customer capture) to legitimate their actions, (Karsten, 1995). The removal of organizational legitimacy for a group's activities meant that they could not establish and conceptualise the role of a system, resulting in declining usage, (Orlikowski et al., 1995b).

Structure is seen as routinisation of actions Tyre and Orlikowski (1994) existing as practices Orlikowski (2002a), while Orlikowski, Yates et al.(1995b) equate structure with

institutional properties of organizations. By knowing when to draw on interpretative schemes actors can enact governance structures, seen as a combination of rules and resources, (Karsten, 1995). Actors may draw on institutional, interpretative and technological rules and resources Orlikowski, Yates et al.(1995b) to enact organizational properties through agency so that structures only exist through actions, which sustain them, or through sustained adjustment of practices enact social change, (Orlikowski, 1996). Structuring properties support work, norms, hierarchy and evaluation in the firm, (Orlikowski, 1996)

Archer (1990) argues that Giddens, by making structural properties 'atemporal' removes the idea that over time, however short, it takes for a property to change it still exerts a possibly significant influence, failing to reflect the durability of constraint. Thompson (1989) does not believe that structural constraint can be defined in terms of rules and resources (e.g. a worker in a capitalist system must take 'a' job- no choice) it being misleading to force such conditions into a definition of structure. He redefines Giddens notion of 'feasible option' which may be limited by agents wants and desires.

Archer (1990) argues that social properties, existing virtually only in instantiation makes them depend on agency rather than the nature of the property itself resulting in excessive voluntarism: giving the actor too much freedom. She argues that a specification of constraint should answer who is limited by constraint, when and how actors are constrained and identify vested interests in stability. She believes that it is misleading to view stability as involving habitual actions with destabilisation possible via changes of habit. Typically sociology sees certain properties as resistant to change or engendering change at different times enabling social constitution and reconstitution causing her to question when structural properties become important, (Archer, 1990).

3.3.1 DUALITY OF STRUCTURE

Boland & Tenkasi (1995:357) cite Bruner (1986) who argues, in parallel with Giddens (1976) that "*when we narrativize experience, we also construct and validate the self.*" Another factor reflecting the socially constituted nature of practices is that by constituting the enactment of a practice an actor also engages in the construction and development of

their own identity and the collective identity of the group, (Brown and Duguid, 1991). Work practices are critical to understanding identity and knowledge at work as the development of noncanonical practices enable an individual and community to reconceptualise and construct their own identities through perspective-taking, developing these through participation, Brown and Duguid (1991) and requiring inferential and judgemental processes Boland and Tenkasi (1995). These practices are social and cumulative, with a history of practice developed, (Brown and Duguid, 2001). The identities created are dynamic, varying with different organizational practices, and are developed by learning to put knowledge into practice within a specific context: the context shaping individuals' perceptions and outlook on the world. This results in the acquisition of an identity manifested by the individual acting in socially recognisable ways so that they gain recognition and social acceptance as belonging to a profession, (Brown and Duguid, 2001). Practices are socially constructed as where a shared understanding is created that reflects actors perceptions of the world, (Brown and Duguid, 1991). The knowledge and identity acquired by individuals are more likely to those of a particular practice than of the organization as a whole, (Brown and Duguid, 2001).

Social systems are not composed of roles but of reproduced practices and it is the latter, via the duality of structure, that are the 'points of articulation' between structures and agency, (Giddens, 1979). Central to the concept of structuration is the duality of structure between the structural properties of social systems, which are medium and outcome of the systems constituting practices, (Giddens, 1979). The modalities of structuration enable 'mediations' or 'transformations' to occur in social systems by binding space and time, (Giddens, 1979).

In producing social interaction actors draw on rules and resources, thus the actors reconstitute them through interaction, (Giddens, 1979). The duality of structure involves actors drawing upon the modalities of structuration (resources, signification and interpretative schemes) in interaction which are a structural property of social systems while simultaneously being the media of reproduction, (Giddens, 1984). They may be seen, through bracketing institutional analysis, as stocks of knowledge and resources used in interactions whereas, bracketing strategic analysis, they are institutional features of social or system interaction, .

While structures only exist in moments social systems exist in space and time as the social reproduction of interdependent action between actors and collectivities is best analysed as recurrent social practices, (Giddens, 1979, Giddens, 1984). The structuration of a social system can be studied by examining the application of rules and resources as produced and reproduced through interaction, while considering unintended outcomes, (Giddens, 1979).

While (Layder, 1981:3-4) referred to in Outhwaite (1990a:68) considers the system/structure distinction is ‘unnecessary and misleading’ with no advantage to be gained by treating social relations as separable from rules resources and the wider structures of domination and power that both underpin and legitimate them. Referring to what he calls a ‘simultaneity model’ Layder asks the questions of whether objective structures can be both outside and determinative of action while at the same time being the internally generated outcome of such attractions. This is what he believes simultaneity model requires us to accept. In Outhwaite (1990b) in response to this question the author claims that it is not clear that a contradiction exists regarding the notion of structures both governing action quite the same time being sustained and reproduced through action. Indeed, the author questions where might structures be located if not, as Giddens argues, in the broad concept of memory traces.

According to Giddens (1979) agents knowledgeability is necessary for his conceptualisation of the duality of structure. *“Knowledgeability or knowing-in-practice is continually enacted through people’s everyday activity; it does not exist ‘out there’ (incorporated into external objects, routines or systems) or ‘in here’ (inscribed in human brains, bodies or communities)”*, (Orlikowski, 2002a:252).

Practices are seen as being both individual, in the sense that they are performed by individuals in their everyday work, and also institutional as they both shape and are shaped by organizational structures and norms, (Orlikowski, 2002b). Groth (1999) admits this is a controversial point referring to Silverman (1970). As Groth (1999) says *“For if organizations are constituted only through the actions of their individual members, there seems to be no room for characteristics that are not traceable to one or a number of individuals.”*, Groth (1999:31) however, states that he believes this paradox can be resolved by consideration of the nature of systems. ‘Real’ systems such as an animal or organization are composed of parts and can be divided physically into their constituent

parts, however the systems are not defined in terms of their parts but rather through the interrelatedness of their parts and so the systemic characteristics of organizations derives from the actions of their members which have to be constituted through “*concrete actions of concrete people*”, (Groth, 1999).

3.4 LINKING AGENCY AND STRUCTURE- MODALITIES OF STRUCTURATION

Agency, at the micro-level, and structure, at a micro-level, are conceptually linked through practices. Agents enact recurrent practices which act to provide structuring properties for future action. These practices can be understood as being composed of three, what are termed ‘modalities of structuration’ comprising two categories of rule, concerning shared meanings and norms and of resources.

3.4.1 RULES

The most important type of rules are those ‘deeply sedimented in time space’ that reproduce institutionalised practices, (Giddens, 1984). Again context specificity is important as rules must be considered within the context in which they are used. This is because firstly, practices and activities are enacted in the context of connected and overlapping rules, with no direct connection between a rule and an activity and secondly, rules exist in combination with practices: they (rules) are not describable in terms of their own context, (Giddens, 1979). Rules are the medium through which actors produce and reproduce practices, not a generalisation of what actors do, (Giddens, 1979). They are shared implicit assumptions regarding interaction that, by pre-existing it, structure a relationship, (Borg, 1999). Because rules involve knowing how to go on they may have no real definition, (Giddens, 1979). Rules can be transposed, or extended to suit new situations, Sewell (1992) in (Borg, 1999). Resources are the ‘bases’ of power, drawn upon by actors in interaction, that provide a structure of domination, (Giddens, 1979).

Outhwaite (1990a) sees a response to criticisms laid by (Layder, 1987) and (Thompson, 1989) that structure, defined as rules and resources is too narrow a definition, with Giddens emphasising that rules should be viewed as broader than rule following when used to produce and reproduce social practices as well as by Giddens greater prominence of structural principles.

Giddens' definition of structure is 'novel' with elements of social system commonly held as part of traditional definitions of structure, (Thompson, 1989, Outhwaite, 1990a). Because 'structural principles' are defined by each rule employed by actors there are no intrinsic grounds for viewing some rules as more fundamental than others: thus diluting the concept of social structure, (Outhwaite, 1990a).

Thompson (1989) believes Giddens conception of rules generates confusion and is of questionable value while Sewell (1992) criticises Giddens for not providing examples of the rules underlying social practices. Sewell (1992) is more satisfied with rules as generalisable procedures used to enact/reproduce social life, a re-conceptualisation by Giddens (1984) since (Giddens, 1979). Because rules are conceptualised as generalisable and virtual, capable of extension and transformation Sewell (1992) feels that the word 'rule' with connotations of prescriptiveness and formality be replaced with 'schemas'.

Archer (1990) is unhappy that in the 'chronic recursion' of social life where, in drawing on structural properties (rules and resources) actors need to invoke the entire structure-requiring structure to be extremely coherent for stable reproduction to occur. Alternatively, where resources are readily convertible and rules endlessly interpretable the result is 'hyperactivity' with actions becoming 'variegated' and society becoming volatile, (Archer, 1990).

Giddens tries to remove ambiguities regarding definitions of 'rules' by considering 'rule following behaviour' used in knowing how to go on as part of practical consciousness though the actor may not be able to formulate it. Thompson (1989) argues further that rules cannot be conceptualised in isolation from resources and are open to rival interpretations and continuous transformation in their application. Thompson (1989) would like to see Giddens provide clear and consistent examples of what constitutes a rule: an important question being which rules are important in studying social structure.

Thompson (1989) argues that by analysing social structure separately from the associated rules it is possible to justify criteria of importance for rules in line with Giddens belief that some rules are more important than others.

3.4.2 STRUCTURE OF SIGNIFICATION

“Structure is understood as the set of rules and resources instantiated in recurrent social practices”, Orlikowski (2000:406) and does not exist independently of individuals’ knowledge of their day-to-day activities, (Giddens, 1984). What a social practice is, at any time, depends on actors to interpret it, as it has no intrinsic nature or essence which can be faithfully captured using language, (Tsoukas, 1996). The structure of signification is important in the practice-based view. Social action is made meaningful through actors’ interpretations of their own and others actions, (Hirshheim et al., 1991). Interpretation schemes involve not only what is understood but also how that understanding is instantiated in action, (Karsten, 1995). Rules of signification may be tacit Crowston, Sawyer et al (2001) and may be intensively or weakly sanctioned, (Lyytinen and Ngwenyama, 1992). Where actors interpretative schemes are influenced by the organizational culture and norms the appropriation of a technology maintains the status quo, (Olsen and Myers, 1999).

To explain noncanonical events actors construct narratives and so surface the interpretative schemes characteristic of a particular community of knowing because meanings (in the socially constructivist language game model) are symbolic and inherently ambiguous- taking on meanings with use, (Boland and Tenkasi, 1995). Tsoukas (1996) refers to discursive practices where words meanings are established through their use in discourse. Communities must possess unique interpretative schemes, called ‘communities of interpretation’ by Brown and Duguid (1991) or they would not be engaged in different knowledge work, which makes sharing ideas difficult and results in different interpretative schemes surface when attempting to reconcile differences among communities of practice in perspective-taking, (Boland and Tenkasi, 1995). Because neither the language game or the knowledge created originates from an individual actor, Boland and Tenkasi (1995) the meanings around communities’ practices exhibit structuring properties.

Where different groups possess differing interpretative schemes interaction and communication may be difficult, with information systems capable of supporting a particular groups interpretation, (Walsham, 2002). Where meanings were viewed as idiosyncratic employees were reluctant to share their understandings through an information system for fear of misunderstandings by those with a different perspective, (Hayes, 2001).

Groth (1999) sees employees' actions being heavily influenced by their interpretative schemes which, referring to (Goffman, 1974), enable them to make sense of actions and events so that over time regularities emerge around patterns of actions which have acquired a commonly understood meaning creating growing expectations around the durability of those patterns.

Rules of signification enable, inhibit and inform the communication process and, from an organizational perspective, impose constraint through structures of signification, (Orlikowski and Baroudi, 1991, Orlikowski, 1992). An important meaning involves how a group sees an information system as meeting its needs with ICT's enabling the development of new significations, (Karsten, 1995). A fundamental meaning structure for groups and societies involves how knowledge is viewed and shared, (Walsham, 2001b).

Meanings may be highly codified in legal language Crowston, Sawyer et al.(2001) or embedded in management accounting conventions, (Macintosh and Scapens, 1991). Accepted meanings around organizational values may affect how rules about technology use are developed, resulting in particular organizational practices, (Robertson et al., 2001). Workers may draw on knowledge of the organization or system building methodologies in developing software, (Orlikowski and Robey, 1991). Technology may be central to employees meanings of themselves and their work, (Mantovani and Spagnolli (2001) which many affect how work is accomplished and its quality, (Orlikowski, 2000). To ignore certain interpretative schemes may result in heavy sanctions including a loss of reputation, (Karsten, 1995).

Changing the communications media may change the meaning of communicative practices, Orlikowski, Yates et al.(1995b) as well as altering actors' world views and protocols for interacting, (Orlikowski and Robey, 1991). It was argued that meaning may

be created by coded knowledge and assumptions into systems Orlikowski and Robey (1991) so that in the case of GIS's, where embedded meanings clashed with national culture there were implementation problems, (Walsham, 2002).

Actors' cognitive frames Orlikowski and Gash (1994) existing only in the mind, constructed through recursive routines surrounding use of a technology, may exert structuring properties, constraining and enabling and may exist at a group level. Inter-group conflict may arise where there are differing group meanings around a technology Crowston, Sawyer et al.(2001), which may arise from actors organizational position Karsten (1995) with lower levels (personal assistants) in some cases exhibiting power to circumscribe system functionality, (Olsen and Myers, 1999).

The rules of signification were drawn upon by managers where they had insufficient rules established and were influenced by external institutions (Montealerge, 1997). Communicative norms were significantly affected by the metastructuring of a small group, through routine and deliberate interventions to promote specific communicative practices (Orlikowski et al., 1995b). Shared understandings were gradually formed through evolving interpretations, destabilising existing structures, (Karsten, 1995).

3.4.3 STRUCTURE OF LEGITIMATION

Tsoukas (1996) raises the question of why, in considering social practices, there can exist both diversity and consistency in patterns of behaviour? He argues that this is because of individuals' actions to manage a tension between social roles or positions, interactive situations and dispositions. The organization tries to define normative expectations around an actors' role through explicit rules and socialization so as to homogenise their behaviour. However there is a difference between these normative expectations and the actors individual dispositions (*habitus*) that reflect past socializations and differing social contexts experience in the persons' life and so there is a 'relative autonomy' regarding external determinations, (Tsoukas, 1996). Both dispositions and normative expectations are activated within an interactive situation with such activation being local matter, when individuals select out what they perceive as the relevant aspects of role-related normative expectations, and select the relevant aspects of the local situation, seeking to bring the two

together, (Tsoukas, 1996). In this conceptualisation Tsoukas (1996) refers to Giddens (1984) in saying that “*social structure, understood as a set of normative expectations and dispositions, is neither ignored nor seen as exogenous to action*”, with the instantiation of social structure always being a local matter.

3.4.4 GENRE RULES

Yates and Orlikowski (1992) draw on Giddens (1984) concept of social rules to posit genres are enacted through ‘genre rules’ which link elements of structure and form to particular social situations. Genres are the vehicle of communicative action because genre rules are drawn upon during organizational communication. Genres are also the outcome of communicative actions as actors reproduce them over time.

Genre rules may be tacit, having been socialized or developed through habitual use or alternatively you may be codified into specific standards that regulate the form and substance of the communication, (Yates and Orlikowski, 1992).

Not all the rules that constitute a genre may be present in any particular instance of that genre, however there must be sufficient distinctive genre rules info for the relevant community to recognize it as an instance of a particular genre, (Yates and Orlikowski, 1992). Not all sections of the solution may be used: the rationale may be omitted, an act of agency.

While genres are generally reproduced over time through a process of structuration such processes may also change them because genre rules you do not provide a ‘binding constraint’. Genres maybe ‘maintained’ when genre rules are enacted without alteration. ‘Elaboration’ occurs when agents consistently and slightly adapt genre rules without substantially departing from the established genre rules, so as to reflect new conditions. Where there is a significant and persistent departure from genre rules this is defined as ‘modification’ of the existing genre. Perceptual or material changes in the situation may need to genre modification: one example cited in being a technological changes. Modification may be deliberate or inadvertent, (Yates and Orlikowski, 1992).

3.4.5 RESOURCES

Resources are the means that enable normative and meaningful context to be actualised, (Giddens, 1979). Power relates to interaction as it is institutionally involved in interaction processes as well as, from a strategic conduct perspective, how it is used to accomplish ends through agents' capabilities to act or refrain to achieve an outcome, or cause another to act otherwise, linking power to agency, (Giddens, 1979). Power, as transformative activities, is instantiated in action through the use of resources and is reproduced in structures of domination, (Giddens, 1979). Actors may draw upon and reproduce two types of resources: authoritative- the ability to command others, and allocative; providing command over material phenomena and objects, (Giddens, 1979). Power relations in social systems are always two-way even if skewed, (Giddens, 1979). Similarly to agency, power has no connection to intention, wanting or motivation, (Giddens, 1979).

Sewell (1992) believes Giddens' classification of resources is potentially useful but requires reformulation: suggesting "resources are anything that can serve as a source of power in social interactions", composed of human and non-human resources. Resources may be asymmetrically distributed but for agency to exist people must have access to some resources, (Sewell, 1992).

Archer (1990) does not accept the argument that resources only become materially 'existent' when instantiated, countering that material constraints exist in their own right: the question being how they are dealt with. She argues that knowledge in a library has potentials and limitations independent the limitations and constructions imposed on it.

Key actors may affect implementation through defining and changing rules of legitimacy and signification around a technology, affecting communicative practices, (Orlikowski et al., 1995b). Groups as well as individuals such as a managing director or financial assistant may draw on rules and resources that suit their own perspective, (Karsten, 1995).

Particular technologies may exhibit 'interpretative flexibility and so may be adapted and used in varying ways, Walsham (2001a), (Orlikowski, 1992). Some systems, such as intranets and groupware are potentially capable of multiple meanings while centralized systems such as mainframes tend to encourage standardized meanings, (Newell et al., 2001).

3.5 COMMUNICATIVE GENRES

This section will examine the literature stream on communicative genres. It will begin by examine the types of genres identified in previous studies. The next sub-section considers the norms that are developed through the recurrent use of genres. This is followed by a brief examination of the communicative repertoire developed by genre users through development of a set of routines through which to communicate. Finally, ways in which genres can be structured is examined.

3.5.1 GENRE TYPES

Yates and Orlikowski (2002) identified three genre systems. The meeting genre system involved communications relating to meeting agendas, meeting logistics, the meeting itself, and subsequent minutes. The PSE meetings genre in PI-CORP were informal with no set agenda needed as each meeting had only one topic-the case at hand. Meeting logistics in this instance involved relating a solution to a free and knowledgeable employee: it was informal and relied on physical abuse as well as social knowledge of others. There was a variance in the meeting genre depending on whether the help giver was aware of the solution and their help giving style. If one minutes of the interaction were not required in more valuable outcome might be developed: a draft solution. This genre system is heavily influenced by information systems which compartmentalize problems and hold solutions. This leads nicely to the second genre examined by Yates & Orlikowski (2002): the collaborative authoring genre. (Yates and Orlikowski, 2002) found that this focused on offering texts: a collaborative act involving three genres- a distributed draft, responses to this draft, and a final version.

Crowston and Williams (2000) studied 1000 web pages, categorizing them into genre types. They found that while many web pages recreated established genres some took advantage of the linking and interactivity capabilities provided by the Internet resulting in the emergence of novel genres that were suited to the unique communicative needs of the audience. Crowston and Williams (2000) found ‘adapted’ genres such as the ‘frequently asked questions’ category has emerged as a distinctive genre on the Internet and Usenet.

Du-Babcock and Babcock (2007) identified three types of genre pattern: professional genre, commercial genre and relational genre. 'Professional genres' involve a specialized language used in a discipline by professionals. These professionals possess a similar educational background or experience. They possess a similar knowledge base to a greater or lesser extent. This genre extends across the firm's and identity is and has a universal scope, (Du-Babcock and Babcock, 2007).

The 'commercial' genre crosses firms and industries, focusing on individuals rather than professionals. This genre describes the information exchanged in commercial transactions that take place in particular companies or industries. The vocabulary used is local and 'artificial' relating to a company's products, (Du-Babcock and Babcock, 2007).

The 'relational' genre focuses on social situations in organizations and professions that "creates the social fabric of a group by promoting relationships among group members/language communicators" Du-Babcock and Babcock (2007) quoting Keyton (1999) it includes the exchange of personal and social messages. The language and vocabulary are general and non-specialized with the scope of the genre both universal and local. In the professional genre and factors that are all on shared professional knowledge to develop a contextual framework within which to interact: this being the basis of successful communication, (Du-Babcock and Babcock, 2007).

3.5.2 GENRE NORMS

Yates, Orlikowski et al.(2003) found that communicative norms were enacted in three primary ways. Some were established 'upfront' before work commenced, based on members' previous experiences and were stated explicitly. Other norms were developed in response to problems or events: the normal was developed to solve the problem and avoid its reoccurrence. One way of achieving this was to create explicit norms to standardize the form of communication, a 'genre'; an example being the 'update notification' genre where details of updates to codes were made available to the rest of the team. Finally, some norms emerged over time as a result of slow adjustments and adoptions by members as they interacted over time. One example given by the authors is the use of frequent short telephone interactions in preference to gathering sufficient information for one long

interaction in the case of virtual teams. Yates et al. (2003) found that norms evolved to suit the work task and context.

Yates, Orlikowski et al.(2003) found ‘emergent’ norms particularly dominant in their case company with subtle tacit a just months occurring to increase the virtual team alignment. Virtual teamwork resulted in both ‘preventive’ norms, through reflection on prior work, and ‘corrective’ norms, in response to an unexpected event or problem, (Yates et al., 2003). ‘Adaptive’ norms reflected the virtual team members continual learning about other members, other members’ tasks and the entire team, (Yates et al., 2003).

3.5.3 GENRE COMMUNICATIVE REPERTOIRES

Woerner, Orlikowski et al. (2004) describing the work of (Belanger and Watson-Manheim (2003) develop the idea of ‘communication mode repertoire’ involving a set of routines that are developed by members of the community when using communications media. A number of mechanisms were found to shape those routines, (Belanger and Watson-Manheim, 2003). Watson-Manheim and Belanger (2007) the found communication media repertoire use was influenced by both institutional conditions (trust, incentives, and physical proximity) as well as situational conditions (task, urgency) and also the routine use of media over time. Du-Babcock and Babcock (2007) based their work on (Yates and Orlikowski, 1992) and (Yates and Orlikowski, 2002) and found ‘genre communities’ based on the linguistic competencies of its members.

Genres are characterized by similar substance (social motives topics and themes communicated) and form (observable linguistic and physical features) (Yates and Orlikowski, 1992). Multiple genres may be embedded are linked to form more complicated patterns of communication, (Crowston and Williams, 2000).

3.5.4 GENRE STRUCTURES

Genres may be defined by their purpose or function (a proposal inquiry), by their physical form (a brochure), or by their document form (directories). However (Crowston and Williams, 2000) argue most genres imply both purpose and form.

‘Why’: is the recognized purpose of a genre system, (Yates and Orlikowski, 2002). ‘What’ provides expectations, both regarding the content of the whole genre system as well as its constituent parts: it involves expectations about the genres that typically appear as well as possible sequencing of those appearances, (Yates and Orlikowski, 2002). The participants and their roles in communicative interactions such as who initiates the genre are encapsulated in the ‘who’ category, (Yates and Orlikowski, 2002). ‘How’ includes the form of the genre in terms of linguistic elements, structure and devices, and media. ‘When’: there may be temporal expectations, such as deadlines, held by participants even if these are not explicitly stated. Expectations around location and place of the whole genre system and specific genres are covered by the ‘where’ category, (Yates and Orlikowski, 2002).

Because Crowston and Williams (2000) only had a few examples of each of the different genres with pronounced differences in form the authors argue that there was not the need for the precision encoding exhibited by Orlikowski and Yates (1994) who coded each message purpose, as well as embedded features such as subheadings, embedded messages or lists. Some imprecision encoding was felt to be acceptable to (Crowston and Williams (2000) in categorizing documents with well established genres because there were more focused on novel genres. While genres exist in hierarchies with varying levels of sub-genres (Crowston and Williams (2000) believe it best to follow Yates and Orlikowski (2002) and consider genres at any level of hierarchy.

3.6 PRACTICES

Practices exist within intersecting sets of rules of signification and legitimation and resources but cannot be explained by a single rule or type of resource, (Giddens, 1979). The difference between interpretative and legitimation schemes is not substantive but

analytical as there are normative aspects to communicating meaning- indeed an actor may calculate and accept the likely sanctions to enact a type of social conduct, (Giddens, 1979).

Focusing on social practices rather than social institutions amplifies voluntarism while minimising constraint and institutional characteristics about which actors are aware, as well as those that constrain without discursive penetration, (Archer, 1990).

Interpretative schemes are at the core of mutual knowledge and are standardised elements of the stocks of knowledge used by actors to produce interactions, with meaning produced in interaction that is shaped by the content of the interaction, which, through reflexive monitoring determines communicative intent to distinguish a context specific meaning, (Giddens, 1979). Signs, only exist as produced and reproduced as a basic element of structuration, recursively linked to the communication of meaning during interaction, (Giddens, 1979). Meaning is always grounded in the context in which the language is used, (Giddens, 1979).

Regulation occurs through legitimation involving normative prescriptions used in sanctioning interactions which, to be binding must be embodied as a structural condition for a portion of a group or society though a legitimate order need not cover even a majority of a group for that groups existence to be stable, meaning that sanctioning normative prescriptions and sectional interests may exist, (Giddens, 1979). Where strategic conduct is bracketed- from a structural view what appears is a legitimate order that is normatively coordinated, with calculative attitudes extended to actors self-presentation, involving a degree of transgression from normative prescriptions being negotiated, or actors attempt, by their actions to affect their conducts sanctions, (Giddens, 1979). Sanctions may be classified according to the elements mobilised to achieve a sanctioning effect and may be pervasive and subtle, (Giddens, 1979).

Practices emerge through ongoing improvisation by actors in response to contingencies, opportunities breakdowns and exceptions resulting in micro-level changes in the appropriation of a technology into work practices, (Orlikowski, 1996). Actors interaction with a technology becomes structured over time as they draw on their skills, power, assumptions and expectations regarding a technology as well as drawing on material properties inscribed in the technology: thus enacting a rule/resource set that structures use

over time, giving a ‘technology in practice’, (Orlikowski, 2000). Because such practices quickly crystallise Orlikowski and Gash (1994) technological practices become reified and treated as predetermined though reinforcement is not ensured (Orlikowski, 2000). Enactment is situated: the interaction with technology will always enact other social structures, (Orlikowski, 2000).

3.6.1 KNOWING AS SOCIALLY CONSTRUCTED PRACTICE

Knowing is constituted and reconstituted through the enactment of practices with knowing and practice being mutually constitutive so that tacit knowledge is a form of knowing and is constituted only through action, with agency essential to knowledgeable performance, (Orlikowski, 2000).

In a more recent paper Orlikowski (2002b) considers practices and knowledge work involved in creating software rather than necessarily using it. Orlikowski (2002b) sees human action as essentially that actors “know how to get things done” to complete complex organizational work. Knowing is the ongoing social accomplishment of actors, (Orlikowski, 2002b). Knowing is constituted and reconstituted through actors engagement with the world in practice, (Orlikowski, 2002b). Competence, for an organization, is grounded in everyday practices of actors, (Orlikowski, 2002b). Knowing: enacted in practices is reciprocally constitutive and so one cannot talk of one in isolation from the other, (Orlikowski, 2002b). Human agency is essential to knowledgeable performance, (Orlikowski, 2002b). Tacit knowledge is a form of knowing and so inseparable from action as it is constituted only through action, (Orlikowski, 2002b). Knowing-how: the ability to perform or act in particular circumstances ((Orlikowski, 2002b) , referring to Ryle (1949) and Giddens (1984) is the ability to go on.

Where there is continuity of skilful practices this is not to be seen as a given but rather as something that is achieved, (Orlikowski, 2002b). *“People’s ongoing engagement in social practices, and thus their reproduction of the knowing generated in those practices, is how they reconstitute knowledgeability over time and across contexts.”* (Orlikowski, 2002b:253). Where capabilities are recurrently generated in action then a ‘continuity is achieved and preserved’ where *“people interpret and experience their doing as ‘the same’*

over time and contexts,” (Orlikowski, 2002a:253). The organization is constituted and defined in terms of these recurrent patterns of action instantiated in interactions among organizational members, (Groth, 1999). These common activities, seen as recurrent patterns of action and employees’ interpretations help define the organization, Groth (1999) in a similar way to Giddens definition of structure as recursive routines, (Samiotis and Poulymenakou, 2002).

An example of embedded knowledge provided by Stankeviciute (2001) are the non-canonical practices of communities of practice from the work of (Seely-Brown and Duguid (1991) which evolves based on everyday practice and narratives of the experiences of community members, making sense only to those who participate in the community. The properties of this type of knowledge involve it being embedding in action and experience, capable of only indirect transfer by sharing, capable of residing in both individuals and social groups, and existing mostly in a tacit form though explicit knowledge is used, in combination with other tacit and explicit knowledge in the process of creating new knowledge, (Stankeviciute, 2001).

Embedded/Encultured knowledge, influenced by Berger and Luckman (1966) sees knowledge as a social product that is embedded in contextual factors and is not objectively pre-given, relating it to concepts of organizational culture, work groups and common languages so that encultured knowledge is embedded in a society and, without a social group would not exist, (Stankeviciute, 2001). Other views of embedded knowledge see it as residing within organizational routines and organizing principles that enable organizational cooperation that exists in a highly tacit form, (Stankeviciute, 2001). The notion of encultured/embedded knowledge is irrelevant in the cognitivist perspective where knowledge is objective and universal, (Stankeviciute, 2001).

A problem with the knowledge management literature is that it conceptualises knowledge as a tangible and explicit entity: concentration is on knowledge as a thing, a noun, rather than a verb, (Pfeffer and Sutton, 2000). Similarly, Venters, Cushman et al (2002) quote Schultz (2000) who argues that if the subjectivist or objectivist perspective is ‘taken too literally’ it may result in a conceptualisation of knowledge that is ‘too binary’ arguing instead for a third ‘constructivist’ approach where there is an interlocking of objectivity and subjectivity making both always necessary.

In the Interpretivist perspective organizations are viewed as systems of distributed cognition which is a process whereby actors may act autonomously, but their acts reflect an understanding of their interdependence with others, (Schultz, 1998).

“Social reality is to be understood in terms of an ongoing dialectical process composed of an individual simultaneously externalising their being into the social world, in internalising the social world as objective reality; ‘to participate in reality is to participate in this dialectic’, Berger and Luckman (1966)”, (Venters et al., 2002, Venters et al., 2005). Orlikowski (2002b) sees her view of knowing in practice as complementing the ‘taxonomic view’. Tsoukas (1996) considers the tacit/explicit dichotomy arguing that tacit knowledge is not, as Nonaka and Takeuchi (1995) argue, internalised explicit knowledge, but is rather a ‘necessary component of all knowledge’ with tacit and explicit knowledge being inseparably related. Orlikowski (2002a) assumes tacit knowledge is a form of ‘knowing’ and is inseparable from action as it is ‘constituted through action’.

Schultz (1998) refers to Cook and Brown (1998) who provide an interpretivist definition of knowledge whereby knowing is seen as a kind of knowledge that is ‘inseparable from action’. Knowledge is viewed, within the constructivist paradigm as time and context specific, subjective, and socially constructed by actors as a result of their interactions and experiences in their environment, and are regarded as viable where they prove adequate within the contexts of their creation, and does not have an absolute value, or at a minimum, actors have no method of knowing that reality, (Stankeviciute, 2001).

The objective of the interpretivist paradigm is to *‘interpret the meanings of social actions’*, by investigating the meanings that people attribute to actions, their own and others, with the objective of better understanding social systems (Schultz, 1998). The interpretivist view sees social reality as being socially constructed with actors constructing a stable society through processes of signification, interpretation, narration and sense-making, seeing knowledge as a process existing as a continuous accomplishment rather than as an object, taking an epistemology of practice rather than an epistemology of possession (Schultz, 1998).

Knowledge as being both shaped and shaping communities' social practices, making it not an object but an *'ongoing accomplishment'*, (Schultz, 1998). Those accepting the subjectivist approach see knowledge identified with and linked to human experience and the social practice of knowing and contend that knowledge is shaped continuously by the social practices of institutions and communities, (Venters et al., 2002).

Knowledge is also seen as inseparable from language as it is language that 'gives individuals and communities affordances to know', Schultz (1998) drawing on (Boland and Tenkasi (1995) and (Berger and Luckman, 1966). Knowledge has an existence in the form of "routines and shared languages, narratives and codes", (McLureWasco and Faraj, 2000). Actors, in order to accomplish organizational tasks need to enact practices that are appropriate to the particular work context, (Orlikowski, 2002b).

A problem with the conception of knowledge as an entity is that the emphasis is on possessing a stock of knowledge presuming that it can then be use appropriately and efficiently: a presumption that Pfeffer and Sutton (2000) argue is unfounded. A reason that knowledge management efforts are 'divorced' from day to day activities is that there is a limited and often inaccurate view of how individuals actually use knowledge to accomplish tasks, (Pfeffer and Sutton, 2000). In a knowledge creating company inventing new knowledge is not a specialized activity but rather a 'way of behaving, indeed a way of being', (Nonaka, 1991). Brown and Duguid (2001) argue for a practice based approach to examining knowledge and the organization, considering how work is performed and they argue, how knowledge is created a point reiterated by (Roberts, 2006).

The 'knowing in practice' focus is informed by Giddens (1984) according to (Orlikowski, 2002b). The constitution of society Giddens (1984) argues that one must gain an understanding of recursively organized practices as it is through these that one can derive hypotheses regarding what actors know and how they apply knowledge during 'practical conduct', (Giddens, 1984). The degree of 'validity' [quotation marks in original] of such hypotheses is provided by how well actors are able to coordinate their activities with others in pursuit of a purpose, (Giddens, 1984).

Each time an individual acts they make use of the habits of thinking acquired through past socializations so that at any time these habits have been formed through participation in historically constituted practices, (Tsoukas, 1996).

Conscious thought is not a large part of everyday operating in organizations due to reliance on cognitive scripts, schemas and recipes until something happens 'out of the ordinary', (Louis, 1980). New members make sense of organization life by drawing on schemas/cognitive maps seen as a structured knowledge base, that use past experiences to make predictions about events and enabled the selection of appropriate responses, (Bloor and Dawson, 1994). Some norms identified by Gorelick and April (2004) when examining sense-making in knowledge management activities in BP were: a face to face peer assistance; virtual team working; the creation of an electronic history of an activity.

Orlikowski (2002b) argues that rather than focus on what actors know (their 'knowledge') the focus is on the practices that, through enactment, exhibit the actors level of knowledgeability. The practice-based perspective undermines traditional dichotomies as between mental and manual work, (Brown and Duguid, 2001). Explanations provided by the practice-based perspective then, are grounded in the practices (activities) that actors engage in to accomplish their work, (Orlikowski, 2002b).

Brown and Duguid (2001) want to emphasise practice which they feel has been obscured by the idea of community making the point that while there may be an assumption that work is accomplished by an individual in fact that individual relies on a communal community knowledge and in circumstances where this communal knowledge is asymmetrically spread within a group then member are able to share it by virtue of their common know how and tacit knowledge. Because of task complexity where one individual cannot comprehend the entire phenomena organizations involve distributed cognition to integrate multiple communities of knowledge workers, (Boland and Tenkasi, 1995). To achieve organizational goals firms will need to rely on peer-to-peer collaboration rather than hierarchies, (Boland and Tenkasi, 1995). Therefore they will need to coordinate communities of practice rather than individuals and coordinate knowledge and practice is more demanding than coordination of traditional routines, as it requires an emphasis on the interests and cultures of communities over issues of individual trust and motivation, (Brown and Duguid, 2001).

Organizational coordination can be helped by using boundary objects such as shared documents, tools and business practices as they explicitly preserve and show changes in practices, (Brown and Duguid, 2001). Collaboration among two communities involves overcoming any incommensurability without losing the communities uniqueness, (Boland and Tenkasi, 1995). In such circumstances, there will no longer be a simple choice or static balance between exploration and exploitation, or spontaneity and structure, but a constant and pervasive need to dynamically balance and coordinate the two throughout the organization. Ubiquitous pressure for change presents a profound challenge to coordination and structure. Thus coordination is likely to be highly unstable, the structure is always under construction and always under threat., (Brown and Duguid, 2001).

The membership and shape of a community-of-practice emerge through a process of activity rather than being specifically created to carry out particular work, so that those in the community of practice within which a problem arises best placed to develop useful knowledge as they are the beneficiaries, (Brown and Duguid, 1991). Perspective-making 'of necessity' causing communities to perceive things differently and become incommensurable, Boland and Tenkasi (1995) with practices creating 'epistemic barriers' and identifiable differences between groups, so employees with similar jobs possess different outlooks and distinctive ways of working, (Brown and Duguid, 2001). A problem with a practice-based perspective is that it emphasized and may even exaggerate the 'balkanization' in internal groups within the firm, (Brown and Duguid, 2001). Communities may be cold and coercive as well as warm and persuasive, occasionally being explosive, (Brown and Duguid, 2001).

Knowledge is defined as the 'social practice of knowing', (McLureWasco and Faraj, 2000). Knowledge is seen as being collectively owned and maintained by a community, (McLureWasco and Faraj, 2000).

"community knowledge is more than the sum of its parts. Community members provide social 'affordances' (Cook and Brown, 1999) that scaffold knowledge creation in practice", (Brown and Duguid, 2001:202).

Communities of practice can act to store, develop, reproduce and maintain knowledge, but that knowledge is not distributed equally over the community, (Brown and Duguid, 2001).

Possible locations for communities of knowing are: functional areas, product lines, divisions, professional specialisms, project teams and task based committees, (Boland and Tenkasi, 1995). Communities of knowing in knowledge intensive firms overlap in complex ways, with individuals being members of several communities, (Boland and Tenkasi, 1995).

3.6.2 COODINATION AND COLLABORATION

In the case of some companies collaboration needs to be achieved over large distances: it is distributed. In her paper Orlikowski (2002b) considers global software product development, positing that this requires, as well as good ideas, resources and leaders, ‘distributed organizing’: the ability to operate over a number of boundaries: geographic, political, temporal and cultural. The ability to engage accomplish global software development is a collective and distributed activity and is grounded “in the everyday practices of organizational members”, (Orlikowski, 2002b). Collaboration through work practices enables ‘collective learning’ to be enacted, thus supporting communities of practice, (Samiotis and Poulymenakou, 2002).

A key challenge where there is distributed cognition is to coordinate purposeful individuals so that actors take their interdependencies with others into account when taking action and when making interpretations, requiring the surfacing and examination of individual understandings which may be achieved through self-reflection on the part of the actor or through interaction and dialog with others, (Schultz, 1998). Because (from an interpretivist view) organizations are in constant flux, with a potential for new and innovative practices never exhausted, an incompleteness of knowledge and the dynamic nature of a world that is socially created then the knowledge management challenges, according to Schultz (1998) to “facilitate the continuous process of appreciation for the interdependence between individual actors that need to act as a collective.”

“We then have a system [organization] that exhibits both stability and dynamism. It shows stability in the sense that it is a recognizable social entity with roughly defined rules and a relatively predictable behaviour. It is dynamic in the sense that its constituting members will change and that they over time will come up with new actions and establish new patterns of action” (Groth, 1999:31).

While the firm may see work as individual, the work in practice involves collaboration within a community of practice to complete it, (Brown and Duguid, 1991). Even what might be considered programmed work Tissen, Andriessen et al.(2000) such as accounting, Manninen (1995) or intensive care nursing still involves the team practices as actors produce and reproduce practices through constant sense-making, (Wikstrom and Larrson, 2003). Work may also require collaboration to explain and solve a current problem, be innovative, Brown and Duguid (1991) so as to create innovative products, Boland and Tenkasi (1995) through open discussion enabling the interchange of ideas, (McLureWasco and Faraj, 2000). This may occur through the processes of perspective-making and perspective-taking which are instantiated only through speech and action, (Boland and Tenkasi, 1995).

Brown and Duguid (2001), make the point that while there may be an assumption that work is accomplished by an individual in fact that individual relies on a communal community knowledge and in circumstances where this communal knowledge is asymmetrically spread within a group then member are able to share it by virtue of their common know how and tacit knowledge. Initially this may be supported by training and socialisation into a community. The typical part of socialization Louis (1980) is to give the novice time to get ‘up to speed’. Menguc, Han et al.(2007) examined the socialization of salespeople and found proactive socialization (seeking performance feedback, information seeking, relationship and network building) more important for social integration of them for task clarity. Murphy (2001) found the switching of flight crews limited the time available to develop ongoing conversations and relationships-creating a barrier to sense-making. In being socialized into an organization and newcomer is not only faced with an amount of unfamiliar cues but it may not be clear which cues require responses, (Louis, 1980). Roberts (2006) points out that trust is an important prerequisite to knowledge sharing requiring ability to exist regarding the likely behaviour of others where it is not possible to create enforceable contracts. Bloor and Dawson (1994) argue that the process through which new members ‘are accommodated in two existing organizational cultures’

relies on Giddens (1979) modalities of structuration. Bloor and Dawson (1994) drawing on VanMaanen and Schein (1979) argue that newcomers make organizations alive by learning through entering the socialization process and the interpretive schemes used by other people. 'Mutual engagement' in interaction as being necessary to produce artefacts, while 'alignment' ensures local activities are coordinated beyond the realm of local engagement, (Roberts, 2006).

Genre systems may be enacted habitually or deliberately Yates and Orlikowski (2002) and may be either reinforced or changed by modifying their enactment in a new medium (Yates et al., 1999). Genres may be implicitly structured through everyday use/modification so that by tacit use of a situated technology actors' may depart from established patterns of interaction, (Yates et al., 1999).

The elements of a genre system need not be drawn upon each time the genre system is used but when it is used the components occur in a particular sequence and the constituent communicative actions are performed by the designated individual and so coordination between actors is accomplished, (Im et al., 2004). Prerequisites of successful temporal coordination are that actors understand both the tasks to be performed as well as an awareness of other team members though temporal coordination is also seen as a dynamic capability that needs to be learnt and developed by team members via continuous collaboration and communication, (Im et al., 2004). The unique local contexts within which team members found themselves, as well as recurrent situations, and the nature of their work were reflected in the genre systems used by actors, (Im et al., 2004).

Task specific genres facilitated temporal coordination mechanisms to allocate, synchronise and coordinate work in a geographically distributed team, (Im et al., 2004). Communicative routines were shaped by four structuring mechanisms: substitution, innovation, variation and combination, (Belanger and Watson-Manheim, 2003). Substitution involves the use of communications media as a replacement for face to face communication; innovation involves enacting a different form of communication by using a new medium; variation occurs when similar types of communication are enacted through the use of different media and finally combination assumes that different media, when combined enable more effective communication, (Belanger and Watson-Manheim, 2003)

Members contribute to the provision of knowledge and all community members may access the knowledge provided, (McLureWasco and Faraj, 2000). Within communities ‘news travels fast’ and ‘community knowledge’ is available to community members, (Brown and Duguid, 1991). Cho, Lee et al.(2004) found that pre-existing networks acted as a social liability by constraining learners, in a distributed environment, ability to develop their social networks when participating in a new learning environment.

The problem is that the community of practice must work in organizations that “treat information as a commodity and that have superior bargaining power in negotiating the terms of exchange”, (Brown and Duguid, 1991). Working in these ‘unequal conditions’ it is not reasonable for communities of practice to give up their knowledge freely, (Brown and Duguid, 1991).

Organizations may support actual practices over formal work descriptions in a number of ways. Their career system may promote internal candidates who know and have personally performed work practices, (Pfeffer and Sutton, 2000). Organizational structures should provide communities of practice with a ‘healthy autonomy’ so that they can break free of received wisdom and increase the possibility of accelerating innovations, (Brown and Duguid, 1991). Because of their specialised expertise internal rather than hierarchical structures may be involved, (Boland and Tenkasi, 1995). The organization, by reconceptualising itself as a ‘community of communities’ reduces the gap between actual and espoused values, thus fostering learning, innovation and working and thus should support the detection and support of emerging and existing communities, (Brown and Duguid, 1991).

The focus of formal work descriptions: to deskill workers into performing rote ‘Tayloristic canonical steps’ may blind management to the non-canonical practices that ‘make things happen’, force communities of practice underground, isolate potential innovations and increase the gap between ‘espoused and actual practices’, (Brown and Duguid, 1991). However communities of practice should be legitimated and supported in a non-intrusive way or there is a risk of bringing the community under the restrictive hold of the existing perspective, (Brown and Duguid, 1991).

3.6.3 FEEDBACK

A system involves interdependence of action with feedback occurring through reflexive self-regulation, (Giddens, 1979). The more interdependence of action that exists the more integration (not synonymous with cohesion) is present- exhibited via regularised ties, interchanges, and reciprocity of practices which, between actors, involves social integration and when between groups or collectivities involves system integration, (Giddens, 1979). Two feedback mechanisms are included in the 'stratification model': unacknowledged conditions of action and unintended consequences of action. The former occur due to actors unconscious motives (Giddens, 1979). The latter may be 'systematically incorporated' as conditions of action during the process of institutional reproduction, (Giddens, 1979). Knowledgeability is 'always bounded' by unintended consequences which may result in feeding back into the system as unacknowledged conditions of action, (Giddens, 1984).

Change involves the ability of actors to 'act otherwise' Orlikowski and Robey (1991) as they enact situated actions Orlikowski (1996) and may involve the integration of software into organizational processes, (Orlikowski, 1992). An unintended consequence of monitoring via information systems involved ambitious employees seeking to increase their visibility, ignoring non-monitored local 'safe enclaves' used by the less ambitious, (Hayes and Walsham, 2001). Where the system was viewed as a control mechanism, coupled with a cultural norm of obedience workers used a 'work around' of the system, fabricating inaccurate reports so look good to managers, (Montealerge, 1997).

3.6.4 CHANGE

While structures are reproduced through a process of routinisation social change may occur due to agents' reflexivity, Walsham (2002) or due to material or perceptual changes in the recurrent situation facing actors (Yates and Orlikowski, 1992). Communicative genres may be maintained, elaborated upon (due to new conditions) or modified, where rules are significantly departed from, (Yates and Orlikowski, 1992).

In importing genres into an electronic arena agents may draw on existing norms so as to habitually enact genres, maintaining the status quo or alternatively, improvise around them, (Yates and Orlikowski, 1992).

Given the importance of time and recurrent practices the way change is conceptualised in the practice-based view is important. An impetus for change may result from changes in the external environment, which present the firm with opportunities and problems, (Groth, 1999). As well as external influences resulting in change the addition of new talented professionals into a firm can result in current processes being re-examined in light of these additions, Liedtka, Haskins et al.(1997). Practices can also be influenced not only by the introduction of new members into the firm but also by moving individuals into a work group as in Hellstrom, Kemlin et al. (2000), experienced managers were seen as acting as 'messenger RNA' bringing the 'genetic code' of how to achieve project work to the team and so they acted to transfer particular practices through transferring individuals who were capable of enacting those practices and sharing them with a work-group.

A major source of change are new organizational members or the implementation of a new technology as outlined by (Barley, 1986) and (Tyre and Orlikowski, 1994) resulting in 'slippage' between existing institutional structures and day-to-day actions, which, if they persist, change patterns of actions and ultimately organizational structure, (Barley, 1986). Change may occur due to problems and surprises, (Tyre and Orlikowski, 1994) or because of an unexpected occurrence, request or condition, (Yates et al., 1999). Technology may be modified by inadvertent slippage, inattention, breakdown, unintentional error and improvisation resulting in different usages, (Orlikowski, 2000). For human agents to have the ability to act contrary to or change structures is dependant according to Giddens upon either the willingness of other humans to replicate the new, changed, behaviour, or a reliance on the ability of actors to 'mobilize power-granting resources' in support of the new action (Borg, 1999).

Change is inherent in everyday activity as it occurs through recurrent reciprocal variation in practice, (Orlikowski, 1996). Ongoing changes in technologies and their uses becomes especially important in the case of reconfigurable technologies, (Orlikowski, 2000). The change process may be analysed by dividing it into episodes using 'temporal bracketing' which was used by Orlikowski (1992) to distinguish between design and use phases as well

as by Orlikowski (1993) to develop a process model. While Barley (1986) accepts that structuring of actions occurs as a “ceaseless flow of temporal phases” he segments these into a number of phases based on changes that were seen by organizational member to be significant in order to “better specify the interaction between structure’s realms and to highlight changes that accumulate gradually”. While possible to bracket a technology as institutionalised or ‘stabilized for now’ all applications of technology are provisional and may change in unpredictable and indeterminate ways causing a different structure to be enacted, (Orlikowski, 2000). While Orlikowski (1996) admits that the phases delineated using temporal bracketing are analytical distinctions and conceptually imprecise they enable an analysis of emergent an episodic change.

The change in routines and technological frames was seen as episodic and lumpy between particular groups by (Tyre and Orlikowski, 1993) and (Tyre and Orlikowski, 1994) and, through metastructuration, may seek to reinforce and adjust how technology is incorporated into work practices to achieve change quickly, (Orlikowski et al., 1995b). In the case of Yates, Orlikowski et al.(1999) change was episodic occurring using planned interventions by a group to deliberately change a genre though more emergent purposeful modification of the technology by actors also occurred.

Emergent change arises out of situated practices due to improvisation which are realised in actions and cannot be planned but result in new patterns of organizing, (Orlikowski, 1996). Emergent change resulted tacitly from the situated use of technology over time causing shifts and slippage in practices, which by accumulating caused significant social change, (Yates et al., 1999). As well as considering change in terms of whether it is radical or incremental Orlikowski (1993) also examines the locus of change- whether it was process change or product (or system development) change.

The ambiguity inherent in both organizations and new technologies means that actors redefine their interpretative schemes after implementation of a new technology, (Mantovani and Spagnolli, 2001). Structures of signification are not uniform consistent monoliths (Boland, 1996), but are capable of change through social interaction, (Orlikowski, 1992). In the cases of (Karsten, 1995) and (Montealerge, 1997) new structures of signification regarding a new technology developed gradually requiring resources and interpretations to evolve. This can take a few months, Orlikowski, Yates et

al.(1995b) or be a 'lengthy process', (Karsten, 1995). Systems may act to maintain organizational structures Boland (1996) being introduced by management to support specific meanings, (Montealerge, 1997). Ambiguity surrounding a technology may be reduced where a group enunciates legitimate meanings through documents, (Orlikowski et al., 1995b, Mantovani and Spagnoli, 2001). Even when this occurs implementation may fail where new interpretations clash with existing organizational culture, (Newell et al., 2001).

Knowledgability exists neither externally, inscribed in systems, nor internally, inscribed in brain, body or community, but exists in the moment that it is enacted, with a provisional status, so that it cannot be seen as stable or enduring: it emerges from situated and ongoing relationships of context (time and space), activity stream, agency and structure and is an ongoing social accomplishment constituted and reconstituted in everyday practice, (Orlikowski, 2000). Henfridsson (2000) quotes Weick (1995), who asserts that unlike certainty ambiguity cannot be resolved with more information. There was ambiguity around how to use the various systems though not to the extent of having no clear conception of the technologies role in departmental activities as found in research by (Henfridsson, 2000).

Two complementary models of communication and language are useful for viewing an organization as an open system of communities of knowing: the conduit model Shannon and Weaver (1949a) involving procedures surrounding the transmittal and receipt of messages whilst ignoring its interpretative nature; the second, involving Wittgenstein's language games considers language as embedded, and meaning created, in communities' situated actions being rooted in life experiences, there existing no fixed set of meanings, (Boland and Tenkasi, 1995). The former is more useful in better developed communities that have clarified issues and possess a 'redefined set' of messages, while the latter suits work that involves questioning perspectives, (Boland and Tenkasi, 1995).

3.6.5 RECURRENT PRACTICES AND TIME

Because it is enacted in the moment, its existence is virtual, its status provisional.” (Orlikowski, 2002a). The ‘knowing in practice’ perspective advocates that *“knowing is not a static, embedded capability or stable disposition of actors, but rather an ongoing social accomplishment, constituted and reconstituted as actors engage the world in practice”*, (Orlikowski, 2002a:269).

Recurrent practices are created as actors modify their actions and interpretations in response to feedback generated by others’ actions, (Groth, 1999). Knowing is continuously reconstituted over time and contexts with knowing modified through changes in practices with new practices improvised and invented as actors develop new interpretations and experiences of the world, (Orlikowski, 2002b). The enactment of rules in recurrent situations was used by Yates and Orlikowski (1992) in developing the concept of ‘genres’.

“The ingrained resistance to any change of routines and ways of working in almost any organization is another manifestation of the strength of recurring patterns of action” (Groth, 1999:30).

Time is an important issue in the practice based view. As Groth (1999) argues human increase their ‘collective skill’ through the accumulation of experience from generation to generation, and so the potential skills that may be drawn upon may have been developed over large tracts of time. *“it is as a collective phenomenon, as a meta-mind stretching through time and space, spanning thousands of generations, that human intellect really shines”*, (Groth, 1999:26).

However, if the focus of attention is on isolated acts then it is not possible to understand some of the ‘systemic properties’ that organizations exhibit as the meaning associated with acts is not derived from the acts themselves in isolation but to a large degree the meaning of acts comes from their organizational systemic context, through which they are conceived, Groth (1999), a sentiment similar to (Giddens, 1979, Giddens, 1984). Where *“people interpret and experience their doing as ‘the same’ over time and contexts, then continuity is both achieved and preserved with capabilities being ‘recurrently generated in action’ ”*, (Orlikowski, 2002a:253).

3.6.6 CONSTRAINT DUE TO ROUTINES

Tissen, Andriessen et al.(2000) refer to ‘paradigm paralysis’ where a company has become so ‘attached’ to its operating procedures that it finds it impossible to change them in light of changing environmental conditions. The ability for an individual to generate and try out new solutions is limited by ‘organizational routines, individual expertise, and biased interpretations of the potential value of new possibilities’’, (Liedtka et al., 1997). Giddens (1979) posits that it is ‘not impossible to suppose’ that subordinates may possess a better understanding of the conditions relating to social reproduction than those in dominant positions so that the social system may support the dominant while simultaneously making them ‘more imprisoned’ and largely unquestioning of the dominant perspective.

3.6.7 VIEW OF TECHNOLOGY:

Initially technology was conceived of as mediating the outcome of action and structure, Orlikowski (1992) reflecting the assumptions, goals and ideologies of designers, and as meaningful when activated or appropriated by users in action, Orlikowski and Robey (1991) with developers’ knowledge, values and interests also embedded in technology, (Orlikowski and Gash, 1994).

A distinction is made between technology as a physical artefact as well as being a medium and outcome of human action, Orlikowski (1992) then seen as not existing apart from action as well as exhibiting structuring properties, (Orlikowski, 1993). An analytical distinction is made between technology (communicative media) and communicative genres transmitted via media, interest centring on the genres use of technology drawn upon in recurrent situations rather than any physical aspects if its existence, (Yates and Orlikowski, 1992).

For Orlikowski and Gash (1994) it is how actors’ interpretation of technology affect its implementation that is central as this provides opportunity to change organizational routines, (Tyre and Orlikowski, 1993, Tyre and Orlikowski, 1994). Orlikowski, Yates et al. (1995b) examine the organizational effects of open-ended technologies as adapted to specific contexts. Technology is also seen as similar to organizational properties, able to

shape situated practices through enabling and constraining effects as technological features are appropriated, (Orlikowski, 1996). Changes in the use of reconfigurable technologies are examined using the 'practice-view' (Orlikowski, 2002a).

3.7 THE PRACTICE BASED VIEW AND KNOWLEDGE MANAGEMENT

An implication drawn from interpretivists' objective of gaining understanding is that the most important knowledge management solution involves communities understanding the practices they use for knowledge creation, transfer and use, (Schultz, 1998). As well as this management must recruit actors with strong interpersonal skills and continue to develop these skills, as well as socializing new members in a community, with a need to foster a collective culture that ensures that individuals do not act without considering the ramifications of their actions on those with whom they are interdependent, (Schultz, 1998). Gorelick and April (2004) found team members and leaders embrace, communicated and acted on the basis of basic shared values. They outlined a number of motivating factors in BP. Gorelick and April (2004) found 'internal recognition expectancy' where team members efforts were recognized even without any financial rewards.(Gorelick and April, 2004) Found 'performance outcome expectancy': where knowledge management members believed that they played and meaningful role which was of significance. Gorelick and April (2004) 'individual/team learning expectancy' where a member believed that their personal learning- was a value and contributed to overall learning in the knowledge management situation. Gorelick and April (2004) found 'interpersonal performance expectancy' where members believed that they were seen to be developing and assisting others. Gorelick and April (2004) Personal learning- expectancy was found where the team member believed they were continuously learning- new material.

In order to develop knowledge management solutions cognisance must be given to developing languages or 'communicative genres' which capture the meaning that a community of practice imbues on communicative actions: in this way members of a community of practice can both express themselves in a way that can be understood by other members as well as being able to then interpret others' actions and messages in a manner consistent with the others' intentions, (Schultz, 1998). Hopkinson (2001) found sense-making enabled the development of cognitive structures that are carried forward into

future incidents. According to Hales (2007) The focus of sense-making analysis is on experiences, events and interactions so as to analyse how the unknown is structured as well as how dissonant experiences, coming from events, are made sensible and sensible quoting (Weick, 1995).

Practice involves fully undertaking a task, job, or profession so that practice is central to an understanding of work, with formal descriptions of work involving abstract representations which omit details of actual practice and may both obscure and distort the intricacies involved in practice, (Brown and Duguid, 1991). It is important to not only understand how a task is viewed when completed (opus operatum) but how workers view it where there are unresolved dilemmas and options (modus operandi) which is needed to show how the process of completing a task is structured, Brown and Duguid (1991) who refer to (Bourdieu, 1977). This is particularly useful regarding knowledge work as in this case outcomes, Davenport, Javanpaa et al.(1996) argue, cannot be guaranteed by 'predetermined task sequences' and even where the work was process orientated management concentrate on education and compensation based on outputs. At Ericsson priority was given to what a person could do rather than the knowledge they possessed, (Hellstrom et al., 2000). Hopkinson (2001), while considering car dealers, found they avoided an unpleasant self image by constructing a logic of their network of interactions with other marketing channel. Murphy (2001) examined sense-making in flight attendants finding they privileged reassurance over safety because of how they defined their role: this influenced their performance in emergency situations. Rosa (2001) found that managers in ambiguous or partially understood complex environments defined the problem, by drawing on Weick (1979) idea of behaviour-cognition cycles so that when the problem is no longer ill-defined its solution is held in managers memory a complex schemata.

3.8 CONCLUSION

This chapter has outlined the practice based view of knowledge management. Individuals are seen as exerting power through agency. In particular they can use information technologies in ways not initially envisaged by designers or managers. Individuals reflexively monitor the actions of others and are knowledgeable of the social system in which they interact. Actors knowledgability allows them enact practices so there is a focus

on dynamic knowing rather than a more static knowledge as stressed in Chapter 2. However knowledgability is highly context specific and bounded. Developing shared practices within a community can be achieved through processes of sense-making and transferred by taking the perspectives of others allowing meanings to be constructed through reflexivity of actions.

It was argued that learning is socially constructed with knowledge exhibited by actors as they participate in enacting practices specific to a particular group. Structure is also conceptualised as recurrent practices where actions between individuals and groups are discernibly similar over long periods of time. Structure was defined as virtual because it was taken to exist as actors' memory traces. Based on Structuration Theory agency and structure are seen to exist as a duality, both interacting while requiring the others existence. Agency and structure are linked by rules (meanings and norms) and resources. Each of these three 'modalities of structuration' were examined with reference to the research from the information systems research literature. As these modalities were drawn upon recurrently created practices that exhibited structuring properties on subsequent actions. Where these practices were specific to a particular context they resulted in the development of meanings, norms and the use of resources within communities. While enabling a community to accomplish work these specialised practices created a structural barrier between groups. Some of the practices examined centred on the need for, and ability to coordinate workers in collaborating during distributed tasks.

Practices once developed were not necessarily static. Agents' reflexivity could result in unintended consequences that subsequently acted as initially conditions on future action. Change was also found to occur because of changes in the external environment as well as due to opportunities and problems requiring reflexivity and through the addition of new group members. Types of change identified in the literature ranged from episodic to incremental and from deliberate to emergent as well as in response to the introduction of a particular information technology or system.

4 METHODOLOGY

This chapter outlines the methodology used for this research. Because the practice-based view is so heavily grounded in Structuration Theory, as outlined in the previous chapter, an interpretivist stance was chosen. The author's initial interest in Structuration Theory was partly engendered because of its inherently interpretivist position. Though positivism is initially discussed (4.1) it is rejected in favour of interpretivism (4.2). Having identified and argued in favour of a particular stance, the questions the research will address are presented in (4.3). The remaining portion of this chapter examines the issues surrounding case study research (4.4) through which data is collected, as well as how data was subsequently analysed (4.5).

4.1 POSITIVISM

Epistemology deals with knowledge claims, Walsham (1995) such as 'what is knowledge', Hirshheim (1992) and 'how can reality be known', Schultze (1998). It also considers how valid knowledge concerning a phenomenon can be acquired Hirshheim (1992), interpreted and communicated, Schultze (1998) and constructed and evaluated, (Orlikowski and Baroudi, 1991). Positivism takes the epistemological position that reality involves static laws of causation, tackling complexity through reductionism, Fitzgerald and Howcroft (1998), by identifying individual components of a phenomenon, (Cavaye, 1996). Explanation involves the development of interrelated constructs Cavaye (1996) so that the emphasis is on objectivity, repeatability and measurement, (Fitzgerald and Howcroft, 1998). Positivism, in seeking universal laws so as to produce reproducible and generalisable results ignores the historical and contextual Orlikowski and Baroudi (1991). Using methods for closed systems do not work well in a natural context where there are numerous uncontrolled and unidentifiable variables; the simplifying and abstracting to develop an experimental design may remove sufficient features so that only 'obvious' results are possible, (Kaplan and Duchon, 1988).

This epistemological stance is not appropriate for this thesis as it is incompatible with Structuration Theory and the Practice-based view of knowledge management which take the view that reality cannot be know in terms of static laws of causation, but rather are

socially constructed by knowledgeable and reflective actors who exercise agency as detailed in (3.2) and (3.3). This in turn affects the way in which the underlying phenomena can be examined as outlined in later sections of this chapter,

Ontology refers to beliefs regarding the essence of a phenomenon, considering whether the world is independent of humans and objective or alternatively only exists through human actions which create and recreate it, (Orlikowski and Baroudi, 1991). Ontologically positivists view the world as composed of pre-existing structures which are independent of actors cognition, Fitzgerald and Howcroft (1998). The objective is to discover these structures by designing precise measures, (Orlikowski and Baroudi, 1991).

Structurational research assumes that social structures do not pre-exist but are created and recreated as practices are instantiated, and are not separate from actors' cognition but rely on the virtual memory of actors for a practice to be recreated. Therefore there are ontological reasons why research from a structurational perspective such as this study could not be conducted under the ontological assumptions that underlie positivism.

4.2 INTERPRETIVISM

Epistemologically interpretivists are subjectivist and collapse the distinction between the researcher and the research situation with research findings emerging from the interaction of both, being mediated by the beliefs and values of the researcher, (Fitzgerald and Howcroft, 1998).

Ontologically interpretivists take a 'relativist' position believing in multiple realities that are socially constructed and exist in the mind, capable of variance over language and cultures, (Fitzgerald and Howcroft, 1998, Hirschheim, 1992). Within structurational research, multiple realities can exist with actors drawing upon differing structures of signification, legitimation and domination: for example different realities about the implementation of an information system may exist within organisational sub-groups, (Karsten, 1995). Information systems may be drawn upon by actors to reinforce or create meanings through a dynamic process, (Doolin, 1998).

Hirshheim (1992) argues that, because information systems are social, as opposed to technical, systems the epistemology needed should be from the social rather than the physical sciences and interpretivist approaches have been advocated for information systems evaluation, Serafeimidis and Smithson (2000) and information systems practice (Walsham, 1995). Information technology forms a context within which managers, developers and users interact so as to develop shared meanings and interpretations within a social reality that is 'ambiguous' Doolin (1998) and which requires 'thick description' to enable the researcher to access changing interpretations and subtleties, (Walsham, 1995). Research strategies that attempt to understand a phenomena in its natural setting Franz and Robey (1984) which is context-dependant, suit an interpretative perspective, (Kaplan and Duchon, 1988).

Ontologically an interpretivist information systems researcher can take one of two ontological positions: 'internal realism', seeing reality as an 'intersubjective construction of the shared human cognitive apparatus' or 'subjective idealism' where each person is seen as constructing their own reality, Walsham (1995). Because Structuration Theory sees practices as enacted by groups with individuals sharing and drawing upon similar structures over time it is necessary to take an intersubjective construction.

Interpretivism is an appropriate philosophical position for this study for a number of reasons. Firstly, reality, from a interpretivist approach, accepts a subjective ontology that is a socially constructed product interpreted by actors based on their value systems and beliefs, Darke et al. (1998) and does not have a concrete form but does possess order and regulation, (Hassard, 1991). This is particularly relevant where Structuration Theory is used because, while structures do not exhibit a physical form, they do exhibit structuring properties that regulate the behaviours of actors. Actors create their own meanings through interacting with the world and cannot be understood independently of the actors that make sense of that reality, (Orlikowski and Baroudi, 1991).

Secondly, the aim of interpretivism is to gain an understanding of how actors make sense of their worlds (Gill and Johnson, 1991). Given the importance of actors' reflexivity and their continuing monitoring of their own and others actions in making sense of their social world, interpretivism is seen as an appropriate philosophical position for this research. Interpretive case studies have also been used by researchers into knowledge management

issues such as implementation (Finnegan and Wilcocks, 2006), knowledge transfer (Eskerod and Skriver, 2007), and intra-organisational knowledge processes where clarification rather than measurement was important, (Riege and O'Keeffe, 2007).

Thirdly, epistemologically interpretivists believe that to understand a social process one must 'get inside it' requiring an understanding of how meanings and practices are formed and informed by tacit norms and language as actors seek to accomplish goals, (Orlikowski and Baroudi, 1991). This research is focused on understanding the practices enacted by actors as they perform knowledge work using information systems. To achieve this the chosen methodology must allow the researcher some access to actors' meanings and norms and the resources they draw upon in carrying out their work.

Passion & Pinsonneault (2000) conducted a review of twenty years (1980-1999) of the literature using Structuration Theory. They categorize Orlikowski's work, among others, as a 'mutual shaping perspective'. Their review of this perspective, in terms of methodological assumptions, was that this research involved field studies in context with the researcher taking an interpretive and participant role. The ontological assumption of this view saw information technology as a mutual construction that results from interaction. This perspective's epistemological assumption is interpretivist or 'soft' interpretivist within the investigations conducted so as to detect patterns of similarities and differences. This research study is undertaken from a similar perspective.

Orlikowski and Baroudi (1991) outline four criticisms of interpretivism that must be considered in relation to this research. Firstly, interpretivist research does not examine the often external conditions giving rise to certain experiences and meanings. Within the focus of this study, the practices used in hardware and software support external conditions are examined but limited to the extent that these affect the practices being examined. An example of an external condition is the use to which clients put Pi-Corp's products. This is relevant as it impacts the context in which a problem is solved (section 6.2.2) and so was reported by actors and analysed by the researcher. Secondly, interpretative research does not explain the unintended consequences of action, significant in reinforcing actions, beliefs, roles and power, in sustaining practices and structures, here they refer to (Giddens, 1979). This study, drawing heavily on Structuration Theory, does attempt to include unintended consequences of action such as problems when attempting to increase the

number of solutions in the knowledge management repository (analysed in section 7.1). Thirdly, structural conflicts and contradictions in organisations and society are ignored where there is a divergence with inconsistencies between actors' actual behaviour and their accounts of actions. It is accepted within Structuration Theory that actors are discursive about their actions even to the extent of lying. This study found interviewees were open when discussing actual departmental practices. While accepting that some actions were not organisationally sanctioned they were aware that the practices were widespread and accepted. Finally, interpretivism neglects to explain historical change i.e. how a social order came about or is likely to change over time. This, the broadest criticism, is beyond the scope of this study and so remains a limitation.

4.2.1 EVALUATION CRITERIA

Walsham (1995) argues that interpretivist work is generalisable but the nature of the generalisation is not that used by positivists. Markus and Lee (1999) argue that some researchers inappropriately use positivist criteria to evaluate interpretive research and vice versa. The strength of analysis in interpretative studies derives from the strength of the explanation of the phenomena based on the interpretation of data, (Darke et al., 1998). Evaluation, in interpretative studies, involves evaluating the researchers' interpretations which should be logically consistent so that the rationale for a behaviour or event is compatible with logical principles; subjective, with the study reflecting the actors' understanding; and adequacy, where the researcher exhibits evidence of understanding and explaining the rationale and of processes and actions even where these initially appear irrational, (Cavaye, 1996). For rigor and reliability in an interpretive case study to be established the researcher must provide evidence for research results showing that alternatives were considered and on what basis dismissed, (Darke et al., 1998).

For an interpretivist, frequency analysis are seen as fallacious because frequency is not seen as indicative of importance, rather validity is based upon the acceptance of the scientific community with Lacity and Janson (1994) referring to Lincoln and Guba (1985) who list interpretative validity as demonstrated via: thick description, triangulation of sources and methods, participant review and peer review.

Regardless of the research paradigm adopted by the researcher or the data analysis techniques chosen it is vital the researcher 'demonstrate a chain of evidence' that the analysis has used making the case data explicit and showing how the case study conclusions were arrived at, (Darke et al., 1998). For case studies there are three methods of increasing construct validity: the use of multiple sources of evidence, to encourage 'convergent lines of inquiry'; the establishment of a 'chain of evidence', relevant in data collection; and having a draft of the case reviewed by key informants, (Yin, 1994).

As the research design should involve a set of logically related set of statements then the design quality can be assessed according to certain logical tests, four of which are commonly used in empirical social research: construct validity, internal validity, external validity and reliability, (Yin, 1994). Yin (1994) focuses on two problems with internal validity: first, that for causal or explanatory case studies the researcher may incorrectly conclude that x causes y without knowing that another factor z has caused y; second, case studies make inferences on every occasion that an event is not directly observed, inferring that an event resulted from an earlier occurrence (based on documentary or interview evidence)- the research design should anticipate questions such as whether rival explanations have been examined, is the evidence convergent and does the inference appear to be airtight.

Problems with external validity involve whether one can know if a study's findings are generalisable beyond the current context: while the answer to this problem is analytic generalization this is not automatic as the theory against which results are generalized must be tested through replication specifying the same results should occur in the various instances with this 'replication logic' being analogous to generalizing from one experiment to another, (Yin, 1994).

Reliability involves being certain that were another researcher to follow the same procedures they would arrive at the same conclusions and findings: a goal to aid this being to minimise biases and errors in the study, (Yin, 1994). To increase reliability a prerequisite is to document procedures followed in the original case, making use of a 'case study protocol', making as many steps as possible operational and to carry out the research as if constantly being watched, (Yin, 1994).

4.3 RESEARCH QUESTIONS

It is argued that the state of knowledge in information systems is neither what it could, or should be, largely due to what is considered valid research, (Hirschheim, 1992). Research topics should be of concern to the practitioner community, (Galliers, 1995). It is therefore important that the research questions are appropriate in terms of their value, significance and interest and that these questions are capable of being answered in a useful way, (Darke et al., 1998).

The information systems discipline has been criticised for its gap between theory and practice, (Breu and Peppard, 2001). One study found that only 20% of respondents felt IS research was relevant to practice, (Dalal et al., 1999). Robey (1996) argues that the criterion for selecting research aims should be the practical interests of the IS field, due to its close links to practical business problems. A problem with studies that are of practical relevance is that they are rejected for lacking scientific credibility, (Breu and Peppard, 2001). Research topics should be of interest to key stakeholders and should have the potential to influence practice as well as producing cumulative, theory-based, context-rich, bodies of research, (Benbasat and Zmud, 1999).

The focus of this research study relevant for a number of reasons. It is in an area that is growing because of its increasing importance to business, knowledge work has been described as a 'relatively new and dynamic research area', (Hayes, 2001). The research site, a call centre, are becoming increasingly important as a way of interacting with customers, (Minami, 2009). Though the literature on call centres might suggest the work is scripted and procedural it will be argued in chapter 5 that this is not true of the call centre chosen as a research site. This work also helps fill a call from a review of structural literature "*to investigate settings that appear to restrict agency, for example, ... highly controlled contexts, such as safety-critical systems or call centres*". (Jones and Karsten, 2008:150). Zachry (2000:98) argues that a workplace communicative activities are necessary "*to deepen our knowledge about professional communication*". The research questions posed in this study as outlined in section 1.2 revolve around gaining a better understanding of the practices enacted by knowledge workers in context specific knowledge intensive work that is heavily supported by a knowledge management system.

At a macro level the research is relevant to businesses because of its focus on ‘knowledge intensive practices’ that are of increasing importance to firms’ competitive advantage. At a more micro-level, from a managerial perspective, it is useful because it seeks to understand how practices are enacted as opposed to organizational descriptions of work. This focus on knowledge work is felt to be under-researched Hayes (2001) and hard to manage when managers do not comprehend the minutiae of the work, (Mintzberg, 1988). This makes the research area relevant by examining an area that is both under-researched and important to businesses. It should therefore be of interest to key stakeholders i.e. for managers by increasing their understanding of the phenomena to be managed; for system developers by examining how systems for managing ‘knowledge’ are really used and the potential problems encountered in using knowledge management systems.

Most of the literature that draws on Structuration Theory uses it at a macro-level to provide sensitizing concepts, (Walsham, 2001b) which as (Jones and Karsten, 2008) argue was what was envisaged by Giddens. However, more recently an argument has been made (Jones and Karsten, 2008, Orlikowski and Barley, 2001) for Structuration Theory to be used at a more micro-level by using the modalities of structuration to analyse the details of particular practices this research aims to engage in more micro-level use of this theory.

4.4 RESEARCH DESIGN- CASE STUDIES

“A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of a study”, Yin (1994:18).

A case study research methodology is appropriate where: the phenomenon is contemporary and is to be examined in its natural context; where theory and research are at their formative stages; where the focus is on the dynamics of a single setting; where there is a lack of understanding of why and how processes or phenomena occur; and where individuals’ experiences or the contexts for action are critical, (Darke et al., 1998).

The strengths of the case method are: that ‘reality’ is captured; different aspects of a phenomenon with a large number of variables, which need not have been previously identified can be examined; concepts can be developed and refined for future study,

(Cavaye, 1996). Advantages for case study use in IS include: by studying phenomena in a natural setting the researcher can develop theories from practice; the nature and complexity of phenomena can be understood by answering the ‘how’ and ‘why’ questions; finally, case studies are appropriate where there are few previous studies, (Benbasat et al., 1987).

Case studies also provide an in-depth understanding of the context without necessarily having a priori relationships or constraints Cavaye (1996) and describe phenomena Darke et al. (1998) in significantly greater depth than other methods, (Irani et al., 1999). Because the objective of the research was to examine work practices in a particular context where there existed some, but not an extensive literature, it was felt the use of a case study was appropriate to examine contemporary phenomena in a natural context where boundaries between these are not clear Yin(1994). Similarly, (Riege and O’Keeffe, 2007) chose a case study because the nature of the research problem needed further clarification rather than measurement.

The principle of contextualisation is seek as a key task by (Klein and Myers, 1999) who argue that people are not just products but also producers of history and this should be reflected in how the case study is written up. This idea is central to this study because of the conceptualisation of agency within Structuration Theory where agents are not seen as ‘cultural dopes’ but are able to ‘act otherwise’ and so not only instantiate current practices but act to modify them.

There is a strong MIS case-study tradition, Lee (1989) and both positivist and interpretivist IS research perspectives using case studies, (Darke et al., 1998, Cavaye, 1996). The interpretive case study is a popular qualitative method in IS research because it is well suited to aid understanding between organizational contexts and information technology-related innovations, Darke, Shanks et al (1998) as well as examining human action and interpretations around the use and development of information systems, (Walsham, 1995). An interpretivist case study was used to access some of the ‘rich detail’ of how information systems were used, (Howcroft and Wilson, 2003). Case studies also provide more a detailed perspective on processes and can develop general implications on information systems strategy and implementation, (Walsham and Waema, 1994). (Eskerod and Skriver, 2007) used a case study to discover individuals underlying assumptions relating to their behaviours. In reporting the research interpretivists are not claiming to report facts,

but rather their interpretations of others' interpretations, Walsham (1995) and attempts to elicit meaning from seemingly irrational behaviour, meaning, (Cavaye, 1996).

Case Studies have been used in the area of knowledge management to achieve a number of objectives such as: to explore enablers and barriers to knowledge transfer and how knowledge was embodied and disseminated in public sector procurement (Hazlett et al., 2008), identifying challenges and problems around knowledge transfer between project managers (Eskerod and Skriver, 2007), developing a knowledge classification system in the construction industry (Walters et al., 2007), as well as the interface between knowledge management and learning organisations, (Chinowski and Carrillo, 2007).

(Mezher et al., 2005) used a case study to examine the process of building a knowledge management system in an engineering consulting firm to show how a KMS was applied for design work. A case study was also used to examine systems implementation from a knowledge management viewpoint (Finnegan and Wilcocks, 2006) as well as to describe organisational processes around the implementation of an information system in a call centre, (Minami, 2009). This study takes aspects of the above studies in focusing on the practices instantiated in a call centre on a day-to-day basis, not during the implementation phase but for an established knowledge management system.

4.4.1 CASE SELECTION CRITERIA

In identifying a case study company a number of criteria were used.

- The organisation needed to be either currently using, or in the process of implementing, a knowledge management system.
- The knowledge management system was central to the completion of the day-to-day work practices being examined.
- The workers needed to be considered knowledge workers (as discussed in 2.4) meeting a number of core criteria.
 - The work is not static but reflects changing organisational needs.
 - Ongoing learning and development are required.
 - The work involves discretion and autonomy.
 - The work involves dealing with complex or ill-structured problems.

- The work is relatively unstructured and contingent.
- The workers possess some level of expertise/know-how
- There is a need for workers to exhibit intellectual ability by thinking for themselves when applying their know-how to context specific problems or opportunities.
- Sufficient access to workers could be negotiated so that an understanding of the detail of their daily work practices could be communicated and sufficiently understood by the researcher.

While a number of contacts with potential case companies were initiated it took longer than anticipated to identify a willing case company that met the above criteria.

4.4.2 ACCESS

The scope of the case study may be partially determined by practical concerns such as the research purpose, available resources and the required deliverables such as a dissertation, (Darke et al., 1998). An ideal site for research may not be possible and the researcher may have to accept this limitation and move the study focus to match the site to be studied, (Fetterman, 1998). One method of entry is through a powerful community member, (Fetterman, 1998). There is a balance to be struck in interpretative case study interviewing between over-direction and randomness as with the former the richness of the interpretations may be lost whereas the latter risks seeming disinterested, (Walsham, 1995).

In the case of this research study, once a suitable site had been identified initial discussions took place with key contacts: the knowledge management manager and head of the hardware support department who outlined the work being completed and systems used in the organisation. Access was provided to internal documentation including workflow diagrams, process descriptions and user documentation for the knowledge management system. Though it was the hardware manager that showed initial interest this quickly waned. However, the individual in charge of knowledge management helped to negotiate access to the relevant departments (including hardware) and also provided a sounding board for ideas over an extended period of time.

4.4.3 UNIT OF ANALYSIS

The 'unit of analysis' is what defines the case, with all the data from one unit of analysis forming a single case: it may be an organization, group or individual, event or other phenomenon and must be sufficiently broad and deep that the data collected can adequately answer the research question, (Darke et al., 1998). The unit of analysis defines 'case' boundaries which must provide sufficient breadth and depth to answer the research question, (Darke et al., 1998). The case unit of analysis can be the firm, group, individual, or a specific event or decision, (Benbasat et al., 1987).

Communities of knowing are the relevant unit of analysis in knowledge intensive firms, as knowledge is not created in isolation Boland and Tenkasi (1995) and where the researcher wishes to study learning, work and knowledge and the formation of identities, (Brown and Duguid, 2001). A case study was used by (Allen et al., 2007) using social network analysis to examine formal and informal knowledge-exchange structures and work habits of technical staff. Similarly the everyday work of employees in a software development company were examined using a case study to examine organisational learning, (Elmholdt, 2004).

The unit of analysis used by Orlikowski (2002a:11) was 'social practice' defined as "*recurrent, procedurally-bounded, and situated social action engaged in by members of a community...Practices are engaged in by individuals as part of the ongoing structuring processes through which institutions and organizations are produced and reproduced.*" Activity and practice theory is used by Samiotis and Poulymenakou (2002) to allow an analysis of the workplace context which is performed via individual actions that are performed on a day-to-day basis. Riley (1983) analysed technologists and radiologists roles by analysing the tasks and activities in which both engaged, and how these were associated with each technology.

For this case study research the unit of analysis chosen, following Orlikowski (2002a), was 'social practice'; in particular those practices involving the use of information systems to accomplish knowledge work. The choice of case company and specific department ensured these practices were knowledge-intensive and computer mediated. By choosing this unit of analysis, coupled with the case selection criteria outlined in section 4.4.1 the

objective of the case study was to (1) extend structurational research by examining practices at a more micro-level, using the ‘practice lens’, (2) add to the literature on call centres by examining the degree of agency exercised to instantiate practices in what will be argued in Chapter 5 to be a very structured environment and (3) extend the knowledge management literature by examining practices in a more structured research context than was typical.

4.4.4 DISADVANTAGES

There are some weaknesses in the case study method. There is a lack of statistical generalisability with internal validity limited by the inability to control independent variables while illuminating relationships between variables may not always indicate the direction of causation, (Cavaye, 1996). Regarding a lack of generalisation Yin (1994) argues that equally the same could be said of attempting to generalize from a single experiment, additionally cases are generalisable to theoretical propositions with the goal of expanding and generalizing theories (analytic generalization) rather than generalizing to a population or universe (statistical generalization).

Walsham (1995) argues that interpretive case studies results may be generalised in four ways.

- (1) Development of concepts: which form part of a wider cluster of propositions, concepts and world-views that provide social science theories.
- (2) Empirical work may result in the generation of theories.
- (3) The research may result in the drawing of specific implications for a domain (seen as tendencies rather than predictions).
- (4) They may contribute ‘rich insight’ which may have broad, more diffuse, implications than those contained in the previous three categories.

The research objectives of this study were not statistical but analytic generalisation. This study seeks to develop concepts, drawing on the practice-based research stream, as well as implications for the literature on call centre and knowledge management. According to Yin (1994) one of the primary concerns about the case study method is its ‘lack of rigor’ with sloppy investigations, equivocal evidence and research bias influencing findings and

conclusions. Darke, Shanks et al.(1998) argue that there are practical difficulties with case study research: it can be difficult to scope and design a case study project to enable the research question to be answered appropriately; data collection can be tedious and time-consuming, resulting in large amounts of data; and the number of suitable sites can be restricted with some being unwilling to participate; in reporting case research there is a need to establish the rigour of the process used to develop findings and conclusions, with this method seen as lacking rigour.

In this research the weaknesses of the case study method, such as the amount of data generated, the rigor and difficulty of analysis, and researcher bias (4.4.7) can be minimised by following strict procedures for data collection and are considered in (4.4.8) in the case study database as well as details of data collection (4.4.9) and data analysis (4.5).

4.4.5 SINGLE VS. MULTIPLE CASES

Before data collection a decision must be made as to whether the study will involve single or multiple cases to examine the research question, (Yin, 1994). Interpretive research may involve the unstructured, inductive investigation of a single case, (Cavaye, 1996). Single case-studies are useful where the research involves early theory generation or late in theory testing, (Benbasat et al., 1987). A single case may be designed to include more than one unit of analysis as well as including several instances of a phenomenon, (Irani et al., 1999). Yin (1994) outlines the rationale for a single-case study method: where the single case is critical to test a well-formulated theory, so it can aid in confirming, challenging, or extending the theory; it may be used to examine if theoretical propositions are correct or the relevance of alternative theories. Secondly, it is appropriate where the single case is representative of a unique or extreme case. Third, the single case may be a 'revelatory case', where the phenomenon has been previously inaccessible for scientific study. A disadvantage of the single case method is that the actual case may not in fact be what was initially expected.

The advantages of a multiple case design are: that the evidence is perceived as being more compelling, making the study more 'robust'; the rationale for choosing a single case- that it is rare, critical or revelatory is rarely met, requiring multiple cases to be examined, a

disadvantage of using multiple cases involve the extensive resources and time required, (Yin, 1994).

Though the researcher chose a single case company it was nonetheless possible to study the relevant unit of analysis (social practices) over two departments: additionally the site provided access to knowledge workers at different levels of experience that worked in a number of different knowledge domains. A decision was taken by the researcher to focus on one particular knowledge management context and to examine it in detail rather than provide a less thorough analysis of several companies with different contexts.

4.4.6 THE USE OF PRIOR LITERATURE

The essential reason for initial theory development before data collection is to provide a blueprint for the study to guide the researcher in choosing the data to collect and the strategies to be used for data analysis, (Yin, 1994). The use of case studies to build theory is most apposite when there is little known on a topic, enabling little reliance on previous empirical work, (Gill and Johnson, 1991). It may be legitimate for a case study not to have any propositions: where the topic is being explored though even here a purpose should be defined so there is a criteria for assessing the success of the exploration, (Yin, 1994). Interpretative case studies, entering the field without a priori constructs, allowing them to emerge while trying to understand the phenomenon, (Cavaye, 1996).

In interpretative case studies, the researcher is motivated to develop an initial theoretical framework that considers previous knowledge so as to provide a 'sensible theoretical basis' that can inform the approach and topics of their early empirical work, (Walsham, 1995). A disadvantage of this is that the researcher may then only see what is suggested with the theory reducing the chances of new issues being explored. Therefore, researchers using interpretative case studies need to be open to field data and be prepared to modify their initial assumptions and theories during the iterative process of data collection and analysis, (Walsham, 1995). However while accepting that Glazer and Strauss (1967) would 'play down' the prior use of theory as a guide to data collection Walsham (1995) argues that to do so risks ignoring existing work, with it being tenable to access existing knowledge without becoming trapped by it.

4.4.7 THE RESEARCHER

Yin (1994) outlines the desired skills that researchers using the case study method should possess, arguing that because the procedures used for data collection are not routinised there are greater demands on the researchers emotions, intellect and ego- greater than any other research strategy. The researcher should be able to 'ask good questions' requiring an enquiring mind during data collection. The investigator must be able to listen, sometimes between the lines, which is seen as including sensing more generally as well as observing and taking in large volumes of information without bias. While the researcher must be aware of the objective of the study they should also be flexible enough to change procedures or deal with unanticipated events. At the same time maintaining an unbiased perspective while documenting any changes that have occurred i.e. rigor but without rigidity. As case study data involves not only data collection but also data interpretation the researcher must have the ability to interpret information as it is being collected, spotting contradictions and seeking additional evidence. The final skill discussed by Yin (1994) is a lack of bias on the part of the researcher, so that they are open to contrary findings rather than sticking to a preconceived position.

A weakness of case studies is researcher bias. The interpretive researcher may assume one of two roles: an outside observer or an involved researcher: the former, having less of a personal stake, may find interviewees frank if trust can be established because the researcher will have no personal stake in any particular interpretations. The latter case offers, for a time, an inside view, though the researcher may be seen to have a personal stake in the views expressed and may find it hard to report the part they themselves have played, (Walsham, 1995). There is a need for critical reflection on the part of the researcher regarding how research materials and data were socially constructed through the interaction of the researcher and the subject of the research, as well as a suspicion and sensitivity regarding possible biases and systematic distortions in the narratives collected from participants, (Klein and Myers, 1999).

For this research, because of the technical nature of the work being performed it would have been impossible for the researcher to assume the role of an involved researcher and so accepted the position of outside observer. The ability to 'ask good questions' was aided by a review of the prior literature on knowledge management, Structuration Theory and the

practice-based perspective which provided sensitising concepts rather than defined hypotheses and propositions. These concepts enabled a pilot instrument to be developed. Initial pilot testing across departments and employee experience levels allowed the development and modification of a semi-structured questionnaire in light of the issues and context that emerged. These initial interviews also provided additional probe questions. This process is outlined in Figure 3 when discussing data collection in section (4.4.9).

4.4.8 CASE DATABASE

The creation of a case study database involves organizing and documenting the data collected for the case study. The separation of the database into a data or evidentiary base and the actual report is not institutionalised, with the case data being seen as synonymous with the case report evidence as there is no recourse for a reader to inspect the database to see what led to the findings (Yin, 1994). There must be an explicit 'trail of evidence' connecting case study data to ultimate conclusions, (Darke et al., 1998). By developing a presentable and formal database for a case study that can, in principle be examined by other researchers the reliability of the entire case study is increased, (Yin, 1994). By making it possible to follow this chain of evidence in either direction one can be assured that the evidence used was that collected, that no evidence was lost, thus addressing the methodological problem of construct validity, (Yin, 1994).

By using the NVivo software package the researcher was able to develop an electronic database for the case. This package held the verbatim interview transcripts as well as contemporaneous notes written after conversations with staff and involving the observations of the case study site by the researcher. Also included were the coding nodes (discussed later in 4.5.2) as well as memo documents that described the researchers thinking on concepts as they developed the structure, as presented in chapters 6 and 7.

4.4.9 DATA COLLECTION

Interpretive methods may aid an understanding not possible using positivist methods as the former were developed to analyse written and face-to-face communication therefore possessing different assumptions and procedures, (Trauth and Jessup, 2000). Case study sources of evidence include: documentation, archival records, direct observation and physical artefacts, (Benbasat et al., 1987) who found in a review of IS case studies that all used interviews as a data collection method with half relying solely on interviews.

Data collected as used for genre analysis has typically occurred through interviews Yates and Orlikowski (1992): both semi-structured Orlikowski (1993) and unstructured (Orlikowski and Gash, 1994, Orlikowski et al., 1995b) as well as retrospectively, (Orlikowski et al., 1995b). Interviews were transcribed verbatim, (Orlikowski, 2002b, Orlikowski, 1996). Observation of the physical environment Woerner, Orlikowski et al.(2004) Watson-Manheim and Belanger (2007) as well as of a relevant software application while the work of interest was being performed. In addition to observation of an information system some researchers were provided with access to the system of interest, (Yates and Orlikowski, 1992). The types of documents reviewed included e-mails Yates, Orlikowski et al.(2003) Ghosh, Yates et al.(2004) newsgroups Orlikowski, Yates et al.(1995b) and groupware messages Yates and Orlikowski (1992), a concurrent versioning system Ghosh, Yates et al.(2004) as well as publicly available documentation (Watson-Manheim and Belanger (2007) and firm documentation Orlikowski (1996). Such multiple methods allow for triangulation of data, (Orlikowski, 1993).

Interviews in the case study tended to be open-ended with key respondents being questioned about their opinions, and their insights into certain events so that in the latter case they can be considered an 'informant' rather than a respondent, (Yin, 1994). Where more unstructured interviews are used it provides respondents with more room to answer questions in terms of what they see as important to them, which may then be compared with other responses and used as a basis for subsequent data gathering, (Strauss and Corbin, 1998).

As verbal interviews face problems of inaccurate and poor articulation, poor recall and bias so they need to be corroborated with other forms of evidence, (Yin, 1994). Darke, Shanks et al.(1998) argue that where the research is for a higher degree full interview transcripts should be obtained even though Walsham (1995) believes this results in the interviewees being less frank. Yin (1994) regards tape recording interviews a matter of ‘personal preference’ but warns against doing so where: the interviewee is uncomfortable or refuses permission; the researcher is mechanically clumsy; there is no plan outlined for transcribing or systematically listening to the tapes; or where the tapes are regarded as a substitute for listening.

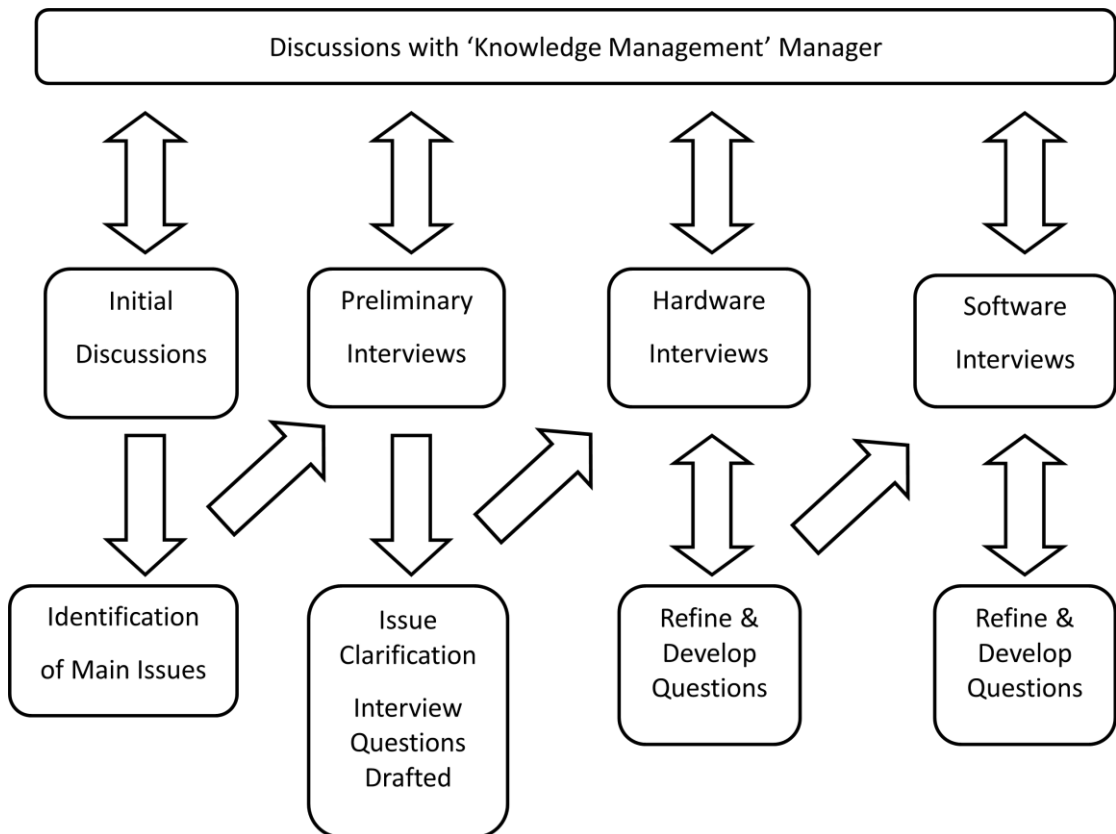
For this particular case study the main method of data collection involved transcripts of semi-structured interviews of departmental employees at a number of different levels as outlined in Table 4.

Table 4 Interview Participants

Level	Number
Managers	3
Shift Leads	3
Experienced Product Support Engineers	12
Novice Product Support Engineers	5
Total	23

In addition documentation relating to formal work practices were made available to the researcher. Other valuable sources of documentation were the solutions in the knowledge repository, the partial output of ongoing knowledge work practices. Data collection and analysis was exploratory and focused on generating insights into the practices and conditions that make up the work of product support. Data collection was iterative: the early stages being more open ended than the latter. Inductive qualitative techniques were used for data analysis, informed by the research aims and objectives. This involved multiple readings of interview transcripts documents and field notes to identify issues and activities of relevance to product development with data analysis being focused by reference to relevant literature similar to (Orlikowski, 2002b). Interviewees were asked to describe everyday activities as well as discuss their project and the organization, key challenges, and flows of communication. Almost all interviews were transcribed verbatim.

Figure 3: Data Collection Process



The available documents provided a context to develop a set of questions and probes for a pilot set of semi-structured interviews which were conducted with a sample of workers from hardware, software and higher levels of product support. The analysis of these pilot interviews confirmed that the company met the case selection criteria (as outlined in section 4.4.1). It also provided the researcher with key knowledge management issues in the company, provided more detail on the systems and thus allowed the researcher to develop the interview questions in more detail for the full study.

Given the location of Pi-Corp the researcher moved to the company's location and stayed on-site for two rounds of interviews; the first round dealt with the hardware support department and the second with software. Interviews were semi-structured and lasted from 30-90 minutes. Interviews were completed with a cross-section of experience levels from novices to specialists with 8 years experience in the department. They also covered a number of organisational levels including: product support engineers, mentors, team leads, shift leads, heads of department and the knowledge management manager.

As well as formal interviews a number of conversations over coffee and lunch were written up immediately after they took place and included in the research field notes. Though most interviews were conducted in a private room off the open plan product support department, some interviewees offered to illustrate particular issues that had arisen in the interview by moving to their work space and walking through the issue as they would see it on their monitor.

Anonymity was assured to each interviewee at the beginning of each interview. Permission was sought to record each interview and this was allowed in every case. This is perhaps not too surprising when one considers that in this highly computerised environment every keystroke was recorded so that every action was visible, not only at the time but for any post mortems carried out when problems arose. Some interviewees did provide more detail after the tape recorder was turned off and these comments were written up immediately after the interview. Interview and field notes were transferred into the QSR nVivo qualitative analysis software program to aid analysis.

4.4.10 SAMPLING

Selective coding involves ‘discriminate sampling’: where sites are chosen purposefully either to minimise or maximise differences, enabling comparative analysis, so as to aid the integration of categories at the dimensional level in order to develop a theory, expand on concepts in need of refinement or to validate relational statements between concepts, (Strauss and Corbin, 1998). (Riege and O’Keeffe, 2007:362) stopped interviewing managers when they got a “*stable pattern of clear agreements and disagreements on core issues*”.

The researcher engaged in ‘theoretical sampling’ which determines case choice based on relevant theoretical criteria which have developed from preceding analyses, (Gill and Johnson, 1991). Theoretical saturation occurs at “*the point in category development at which no new properties, dimensions or relationships emerge during analysis*”, (Strauss and Corbin, 1998:143).

4.5 DATA ANALYSIS

Linking data to propositions and the criteria for interpreting findings are the least well developed elements of the case study research design according to (Yin, 1994). A special type of pattern matching is ‘explanation building’ the objective being to analyse the case study data through building an explanation about the case: while explanation building has been used typically in explanatory case studies, for exploratory case studies a similar procedure is commonly used as part of the hypothesis generating process drawing on the work of Glazer and Strauss (1967). The explanation building process is an iterative one involving: developing initial propositions or theoretical statements about a social behaviour; comparing empirical case findings against these statements or propositions; the revision of the proposition or statement; comparison of case data against the revised propositions; revising the proposition iteratively as many times as required, considering rival explanations at each stage, though the final statement may not have been stipulated fully at the start of the study, (Yin, 1994). A similar point is made by (Klein and Myers, 1999) who argue that understanding is achieved through iterating between the interdependent meaning of parts and the whole they form.

In the case of this research, available data include semi-structured interviews and documentation that explained how work processes were structured. When involved in the coding process the researcher also tried to look at emerging themes in terms of possible interrelationships to other themes and to the research as a whole. It took the researcher considerable time to develop possible alternative explanations of how work was actually undertaken, and by re-reading the data, outline what was believed to be a coherent narrative regarding the work processes. In addition the researcher sought to identify the underlying concepts and analyse them using the sensitising concepts examined in the previous chapters.

4.5.1 INDUCTION

Generalisability refers to the validity of a theory to a setting different from the one where the theory was empirically tested and confirmed, (Lee and Baskerville, 2003). The objective of interpretative studies is not generalisability to a population but rather to understand phenomenon’s ‘deeper structure’, which may be used to inform other settings,

Fitzgerald and Howcroft (1991). Interpretivism seeks to discover and understand patterns, Fitzgerald and Howcroft (1998) using induction as discussed earlier in section 4.2.1. Inferences drawn from a single case study are based on an interpretative epistemological stance: where validity depends not on statistical representativeness but on the cogency and plausibility of the logical reasoning used to describe results and drawing inferences and conclusions from these results, (Walsham and Waema, 1994).

In ‘analytic induction’, one instance of a phenomena would suffice with no subsequent investigations being necessary, though in practice, as Gill and Johnson (1991) argue, one instance of a phenomena is unlikely to manifest all the explanatory elements for a cogent theoretical exposition, therefore requiring an indeterminate number of ‘strategically selected’ events. For the social sciences there are two arguments to justify the inductive approach. Firstly, if explanations are not to be worthless, they must be grounded in experience and observation. Secondly, positivist causal analysis and hypothesis testing is inadequate as the subject matter (human beings as opposed to physical objects) are fundamentally different, (Gill and Johnson, 1991). Orlikowski (1993) used ‘analytic generalization’ to produce more general results with the generalization being theoretical concepts. She argues that generalization can be further extended by using the concepts generated inductively in her study along with insights from existing formal theories which it is argued is recommended by (Glazer and Strauss, 1967).

The outcome of the inductive tradition shows, *“in its narrowest sense a theory is a network of hypotheses advanced so as to conceptualize and explain a particular social or natural phenomenon. In this, each hypothesis presents an assertion about the relationship between two or more concepts in an explanatory fashion. Concepts are the building blocks of theories and hypotheses in that they are ‘abstract ideas which are used to classify together things sharing one or more common properties’ (Krausz and Miller, 1974)”* in (Gill and Johnson, 1991:26). The ‘building blocks of theory’, a concept is a ‘labelled phenomenon’ which, abstractly, represents an object, event, action or interaction, seen as significant and enables the grouping of events that are similar, sharing common properties through which they can be classified (Strauss and Corbin, 1998). It is possible that concepts can be classified in multiple ways, Strauss and Corbin (1998) because the objects possess attributes and depending on how one interprets and defines those attributes, giving them meaning, affects how the concepts are classified.

An objective of this case study is to understand the ‘deeper structures’ of information system-mediated knowledge-intensive work practices. Though the case study company provides one setting induction is used to move from a particular instance of a phenomenon to arrive at more general conclusions. The research will seek to develop concepts and provide ‘rich insight’ into the phenomena using the ‘labelling’ activity described above. How this was achieved will be described in the next section on coding.

4.5.2 CODING

Silverman (2000) rather than analysing texts using quantitative content analysis argues that in qualitative research often a small set of documents and texts can be analysed for a different purpose: to understand the participants’ categories. Based on the ontological belief of social constructivism, interpretivists avoid imposing external categories on phenomena but seek to derive constructs from field study data, Orlikowski and Baroudi (1991) allowing constructs about a phenomenon to emerge, (Cavaye, 1996).

Qualitative data analysis often involves the identification of key patterns and themes which depends on the process of coding data. The authors prefer to think of coding not as a mechanistic act but rather as a means of generating concepts with and from data. Codes bring fragments of data from different places because they are defined as being related to a particular theme or topic. The important aspect of analysis is not the coding process but rather in establishing and thinking about linkages among codes, data categories and concepts, as well as in the identification of relevant concepts, (Coffey and Atkinson, 1996). A mass of undifferentiated ideas and behaviour are gathered into gross categories as the researcher searches for a discernable thought or behaviour which can then be compared to observations with exceptions and variations circumscribing the activity and clarifying its meaning, (Fetterman, 1998).

It is argued as intrinsic to interpretive research that an attempt is made to relate particulars to abstract categories through careful use of field data in order to show how theoretical insights were developed, (Klein and Myers, 1999). In this research the identification of codes and concepts came from the data collected as the research had used prior literature,

in line with Structuration Theory to provide 'sensitizing concepts'. This is also important regarding the 'principle of dialogical reasoning' for interpretive research, (Klein and Myers, 1999). The use of sensitizing concepts reduced the risk of possible contradictions to theoretical preconceptions guiding the research design and the actual research findings. The researcher was open to the traditional view of knowledge management and indeed this was found to be useful in some instances.

Coffey and Atkinson (1996) quote Miles and Huberman (1994) who advocate creating a 'start list' of codes based on a variety of sources-including conceptual frameworks prior to conducting field work. Case study interview data was coded by (Walters et al., 2007) based on headings that had been developed for the American Quality Productivity Centre classification system. Alternatively, few prior categories for coding could be established in the case of (Riege and O'Keeffe, 2007) because their research was exploratory in nature. Based on prior research and interviews with senior managers Watson-Manheim and Belanger (2007) began with five communicative purposes which were used to question respondents and while they were open to new categories none emerged in the interviews. While Miles and Huberman (1994) prefer this approach they do admit the advantages of a more grounded approach favoured by Glazer and Strauss (1967), as the data is more moulded to the codes that represent them and such a method makes the researcher more open minded and context sensitive. For Nandhakumar and Jones (2001) their field notes were written as a case description, in line with Strauss and Corbin (1990) and though content analysis was employed, time-geography was used as a sensitizing device that provided concepts on which interpretations could be based. The objective of their qualitative data collection was to develop an understanding of complex social process is involved in accounting practices.

Content analysis was used to code data by Orlikowski (1993) who categorized it into concepts suggested by the data itself (open coding) with these concepts then organized by recurring themes which were used to create a set of common and stable categories (axial coding). Coding schemes that are too detailed are problematic, (Coffey and Atkinson, 1996). When codes become too large sub codes are required, (Miles and Huberman, 1994).

Another process involves categories being divided into subcategories, divided and linked together some of the codes 'making pathways through the data'. Identifying and matching patterns is eased by using software such as 'Nud*ist', (Fetterman, 1998) which facilitates data coding and categorisation. After the act of opening up concepts it is necessary to group them in more abstract and higher order concepts (categories) to reduce the number of analytic units that are being worked with, (Strauss and Corbin, 1998).

In this research study data analysis began by the researcher reading and re-reading all interview transcripts and company documentation, identifying possible codes from the data, creating these as 'free nodes' in the software package. Because some codes only became obvious when reading later transcripts, once this phase of analysis was completed the researcher had an extensive list (350+) of codes. To make it easier for the researcher to find codes and to help structure the data this list of nodes were grouped from 'free nodes' into the 'tree node' structure by identifying broad themes and sub-themes. As some codes had only been added and available for use in only the last few interviews all transcripts were recoded from a now extensive list of codes.

Once coded, some nodes were found to only have only a small number of transcript portions allocated to them and were either deleted or amalgamated with related nodes. On reviewing the available nodes it was discovered that some names were synonymous or closely related allowing them to be merged. The result was a small number of key themes with a number of 'child nodes'.

Data, once it has been coded, have to be interrogated, exploring it to generate meaning, searching for patterns, themes and regularities, (Coffey and Atkinson, 1996). Comparisons are vital as it is through this process that variations are identified and patterns in the data identified. The researcher should not just be interested in a particular form of a category or pattern but how that pattern 'varies dimensionally', under different circumstances so that the relationships between concepts can be stated more precisely in later stages of the research, (Strauss and Corbin, 1998).

Transcripts were examined by Orlikowski and Gash (1994) using a 'form of content analysis' with the data read and sorted into categories that were suggested by the data rather than imposed externally. Once the themes were identified the transcripts were re-

examined and recorded using the proposed themes. These core themes were examined for similarities and differences across different organizational functions. Once interview files were coded Watson-Manheim and Belanger (2007) performed a thematic analysis where the authors analysed the coded files to identify key themes and patterns of media usage. When several respondents within or across the two cases discussed a similar concept, then a theme was identified. Barley (1986) quotes Riley (1983) who coded interview data on a single structural concepts of signification, legitimation and domination in his research. It is also important that the researcher examine the influence social context has upon the actors under study by seeking and documenting multiple interpretations and the reasons for why these exist, (Klein and Myers, 1999). In the subsequent analysis chapters multiple interpretations of work practices are examined, not only between different categories of actors such as managers and product support engineers but also the different interpretations among product support engineers about what constitutes the core work of the product support department and the resultant differences in practices enacted as a result of these differing interpretations.

Yates and Orlikowski (1992) developed a genre coding scheme based on purpose and form of the messages. While interviews helped to understand organizational issues that influenced team room which allowed the researchers to interpret the genres. (Yates and Orlikowski, 2002) that organised genre systems in terms of purpose, content, form, participants and place to describe genres in their own context of multilingual communication. E-mail threads identified which were sorted into broad categories based on their characteristics, (Yates et al., 2003).

Qualitative data analysis was used by Orlikowski, Yates et al.(1995b) to examine e-mail and newsgroup messages to classify common actions and topics. Initially messages were classified under 97 topics with these categories then categorized under general subjects. Topics that could be correlated with times posted were used to develop a timeline.

The analysis of Pi-Corp outlined in chapters 6 and 7 involved the researcher reading all transcript data relating to the practices engaged in by the product support engineers (PSEs) with initial thoughts about concepts and their possible relationships written up as memos, as suggested by (Strauss and Corbin, 1998). This activity aided the researcher in making sense of how to structure the amount of data available about given themes. Where the

theme focused on a work practice the sequence of activities performed by the PSEs were identified and recurrently mentioned issues in the transcripts relating to each sub-practice/activity were grouped together to make it easier to compare and contrast viewpoints.

Relationships between concepts were explored by the researcher using the nVivo modelling feature. This software capability provided the flexibility to test different configurations of concepts as well as to examine potential relationship patterns when analysing each practice. These models were used to structure the identification and sequencing of headings used to explore the practice. Two practices emerged as being central to the PSE's work: the analysis of cases which comprises chapter 6 and the documentation of solutions in the knowledge management repository in chapter 7. It was found that a number of the other practices identified fitted under these headings and were integrated to their analyses.

4.6 CONCLUSION

This chapter began by examining the epistemological and ontological assumptions that define positivism and interpretivism. It went on to argue that, given the tenets of Structuration Theory and the Practice-based-perspective as outlined in the previous chapter and interpretivist stance was most appropriate.

The largest section of this chapter concentrated in outlining and justifying issues regarding the chosen research design- a single case study. It outlined:

- The criteria used to select a suitable case company.
- How access to this company should be, and was gained.
- The units of analysis used in the case study.
- The value of entering into the case study informed with an understanding of prior research in the area.
- The qualities an interpretive case study researcher should ideally possess.
- The importance of developing a case database.
- How data sampling and collection was undertaken.

This section also dealt with broader questions relating to the advantages and disadvantages of case studies as a research method. It also provides evidence for the acceptability of choosing a single rather than multiple cases.

The final section of the chapter outlined how the data that was collected was then analysed. Analytic induction was used to move from data to generate theoretical concepts.

The case company chosen was a product support call centre and so the next chapter examines the literature on call centres. This company was not a typical call centre and so similarities and differences to more standard call centres are highlighted throughout the chapter. The data that was collected using the case research method involved two main practices in the work of Pi-Corp, how problems were analysed (chapter 6) and how solutions were documented (chapter 7).

5 CALL CENTRES AND THE CASE COMPANY

This section considers the case study company in terms of the literature on call centres. It finds that while call centres vary in terms of the inherent knowledgability of the work they carry out and the knowledge their workers possess Pi-Corp is, by call centre standards, at the more knowledge intensive of the spectrum. It goes on to examine the similarities and differences in how the product support centre is structured and the work that is undertaken when compared with traditional call centres.

5.1 DESCRIPTION OF CALL CENTRES

The objective of a call centre is to process as many calls as possible by the minimum number of suitably qualified personnel, (Graumann et al., 2003). In many cases customer support is offered for free on the basis that the cost of the call centre is less than the losses the firm would incur from dissatisfied customers or alternatively that call centres reduce the costs of maintaining a more expensive network of field engineers thus reducing support costs, (Gray and Durcikova, 2005). This is even more important for Pi-Corp. Given the potential severity of problems customer support is vital, with additional service level agreements available.

The rationale for cost centre repositories are that they establish consistency, reduce cost per call, increase first time resolutions, reduce repeat calls, reduce field service costs, accelerate training, increase both customer and employee satisfaction and allow the company to use less technical call centre staff, (Gray and Durcikova, 2005). Though 'less' technical the product support departments examined in later chapters are still comparatively high in relation to the majority of call centres.

The case company that is the focus of this research is on the more complex end of the call centre spectrum in diagnosing computer related problems Taylor & Bain (1999) where employees (called Product Support Engineers- PSEs) must, like the findings of (Hilmer and Hilmer, 2004), understand complex products and navigate sophisticated technologies.

Similar to Graumann et al. (2003) Pi-Corp may gain some competitive edge through product support for, though its products are finite, their combinations and uses may be overwhelming. The case company is a business to business call centre. These involve higher value added products and services, and were found to be more likely to focus on service quality and customer relationship management, (Holman et al., 2007). The composition of PSE's in Pi-Corp are young, most being in their twenties and thirties. This is in line with Hyman et al. (2003) and Harris et al. (2003).

In general call centres can be distinguished by whether they deal with inbound or outbound calls, Dormann & Zijlstra (2003) with 86% of call centres dealing with inbound calls with only 25% dealing with outbound 'sales calls' (Group, 2000). As well as this the other defining factors of call centre work are the complexity and variability of the product; the depth of knowledge required of staff and the extent that this knowledge is contextually bounded, (Callaghan and Thompson, 2002). In Pi-Corp there is a high variety of work on inbound calls with a highly complex product range requiring a depth of product knowledge greater than typical call centres because of the context specificity of the problem cases.

The product support departments in the case company call centre are atypical when compared with the findings of Holman et al. (2007) in only dealing with larger business clients which was only undertaken by 19% of companies in their sample and 25% who service business customers. While Holman et al. (2007) found 86% of call centres service and local, regional or national markets Pi-Corp uses a 'follow the sun' model with 3 locations around the world each providing global support for a number of hours each day.

The overwhelming majority of call centres are voice only, (Holman et al., 2007). Call centres require different levels of qualifications depending on the nature of the task: unskilled people able to impart standard information as well as technical help desks with highly qualified personnel who deal with unique and complex problems, (Dormann and Zijlstra, 2003). Pi-Corp is in the latter category. Unlike Callaghan & Thompson (2002) where there was limited knowledge complexity and limited depth of knowledge with no discretion on the part of customer sales representatives, in the case company there was high knowledge complexity and the ability for PSE's to exercise agency.

Unlike the Telebank recruitment processes were based on personality traits (positive attitude, enthusiasm, sense of humour), communication skills (energy, fluency, rapport, warmth, tone, pitch) with less emphasis on technical skills (numeracy but also navigation and keyboarding) Callaghan & Thompson (2002) in Pi-Corp technical skills were a *sine qua non*.

Call centre work is considered a lowly skilled job with only 22% of call centres recruiting people with college degrees and with initial training taking an average of fifteen and seventeen days, (Holman et al., 2007). Formal (classroom) training in Pi-Corp took 2-3 weeks but novices required 6-9 months to become proficient at taking more difficult cases. This was where, in the case of software support a degree in computer science and a number of years work experience were required.

Factors affecting turnover include the high levels of sustained customer interaction, a high workload, and a lack of variety in work tasks, Deery et al. (2002) Bakker et al. (2003) with estimates at 18% turnover by Callaghan and Thompson (2002) quoting IDS (1999) and Pertemps (1999). This 18% turnover was also found in Australian call centres by Lewig and Dollard 2003 (2003) who discovered that this increased to almost double in call centres seen as 'high stress'. Staff turnover was found to be low in Pi-Corp and while this may be seen as out of line with the general findings of Holman et al. (2007) who found turnover rates to be running at 20% per year, 25% in liberal economy's such as Ireland they went on to point out that turnover rates for high quality jobs were lower at 9%. This low turnover was attributed to the specialised skills that PSE's build up in knowledge domains only being valuable to PI-CORP clients making moving to a comparable position, where their accumulated expertise would be valuable would require relocation to another country.

While Holman et al. (2007) found 32% of call centres have a high to very high quality jobs or only 12% of customer sales representatives work in such jobs. They also found that in liberal market economies, including Ireland, no job discretion was reported by 49% of call centres. The call centre in this study is again in the minority in offering high quality knowledge intensive employment.

While 80% of call centres reported using problem-solving teams if those involved only a small proportion of employees, (Holman et al., 2007). In Pi-Corp the majority of cases could be solved at an individual level. For difficult problems the PSE could assemble a problem solving team (albeit small) of specialists in the problem domain.

Belt et al. (2002) found call centres sought to recruit applicants with ‘communication skills’ and people skills. Communication skills related to how employees interact over the phone, such as having a ‘bubbly’ personality. People skills were less valued in technical call centres where technical knowledge, qualifications and experience were valued more. Here communication skills were seen in terms of problem solving skills, (Belt et al., 2002).

5.2 ORGANISATIONAL STRUCTURE

The call centre was organised in terms of levels of expertise. This study focused on level 1 support. Like Gray & Durcikova (2005) higher levels of support (level 2 and engineering) were more expensive with even higher levels of expertise. Similar to Graumann et al. (2003) the vast majority of cases were resolved in the ‘front office’ (level 1 support) though referred by the authors as ‘generalists’ this level still required specialised knowledge which was segmented into domains not only as the authors found, in the back office but also in the front office. While as Adria & Choudry (2002) argue call centre workers are vertically interdependent with experts to whom cases are escalated, in Pi-Corp such workers are themselves experts. Unlike Halliden and Monks (2005) who found customer services executives work in teams in this organization in PI-CORP this only occurred when trying to make sense of difficult cases

Call centre managers focus on performance with Houlihan (2001) outlining two further more subtle roles: the management of expectation and the management of interpretations to manage chaos and conflicting messages. In PI-CORP the management of expectations was particularly relevant regarding the degree of participation in certain practices as outlined in chapters 6 and 7. They also act to allocate work to specialist work queues where this is not done automatically. (Houlihan, 2001)

5.2.1 CALLS

Central technologies used in call centres are the automated call distribution (ACD) system for inbound calls and its integration with computer technologies making this labour process distinctive (Ellis and Taylor, 2006, Taylor and Bain, 1999). IP access to call centres can allow client information to be transferred without verbal description making them 'context aware', (Luo et al., 2006). In PI-CORP cases are routed to specialist knowledge groups. In some instances this is automated so that the PSE initiates telephone contact with a client, having first reviewed the case, rather than vice versa.

Call centre staff are presented with digital displays of calls waiting, creating an assembly line in the head, (Taylor and Bain, 1999). ICT's influence work design in call centres by structuring and pacing work, monitoring and measuring output as well as increasing productivity, (Ellis and Taylor, 2006). PSE's are confronted not only with displays of the number of telephone calls waiting but also a list of electronic cases queues that outline details such as client name, configuration, length of time in the queue and estimated severity. Not only can these create a mental assembly line but employees' work in progress folders provide another assembly line in parallel for cases that are worked on over extended time periods.

The opportunity for employees to meet supervisors on a regular basis is provided in problem-solving groups which can provide learning and improve performance, (Holman et al., 2007). In Pi-Corp PSE's meet with their supervisors as needed to solve particular problems.

The ACD system holds the skill profile of each employee in line with the company's internal segmentation structure with expertise levels (generalist and specialist) as well as lines of business, Graumann et al. (2003) this is different to the case company where profiles of individuals are not held: rather problems profiles are matched against, and allocated to, problem domains, based on a taxonomy of error codes.

Some authors consider ‘abandonments’ from tele-queues that are invisible to customers (Zohar et al., 2002). In the PI-CORP case because of the impact of problems (potential transaction data loss) clients cannot abandon the call. However PI-CORP shorten wait times by taking customer problem details, prioritising them by severity (setting their own expectations about call importance) and calling the customer back. Given the nature of the client problems abandonments are not an issue- though the speed of resolution of problems is central.

5.2.2 METRICS

The need for call centres to balance quantitative and qualitative metrics of service and call quality was a constant theme in the call centre literature, (Bain et al., 2002, Houlihan, 2001, Lewig and Dollard, 2003, Shen and Huang, 2005, Taylor and Bain, 1999, Holdsworth and Cartwright, 2003, Callaghan and Thompson, 2002). Role conflict occurs where productivity and service quality are both stressed leading to a contradiction, (Deery et al., 2002).

A key aspect of call centre design is to create standardised work practices through repetitions and uniform activities to ensure consistent quality and reap economies of scale. This results in call centres acting to ‘constrain’ employee skill development, (Belt et al., 2002). The work process is highly visible with an inextricable link between the employee and their work performance (Sewell and Wilkinson, 1992). The main difference between call centres and other organizational types is the use of information technology to frame, monitor and control work, Houlihan (2001) as well as becoming crucial to the call centre management being used to assess the quality of interaction, monitor the speed of work and regulate levels of downtime, (Deery et al., 2002). This is affected by the type of work engaged in by the call centre with this being possible because technical support call centres were found to be the least routinised work with less stringent monitoring and surveillance than others categories of employees, (Belt et al., 2002). In PI-CORP the call volume statistic was used by managers to compare their sites performance against the other two company call centres. It also provided a breakdown by employee which was used to gauge performance.

The call centre environment involves being measured in seconds and with both covert and overt employee monitoring to ensure compliance with precise operating procedures, (Holdsworth and Cartwright, 2003). Typical metrics include the volume of calls, the average time taken and the average 'wrap up' time per call as well as a calculation of CSR 'non-availability', (Deery et al., 2002). Call centre managers focus on two primary tasks: information management and performance management. Central to management and call centres averages and statistics relating to details of service levels, number of calls being handled and awaiting as well as the number of staff in 'idle' mode and are typically available to managers and supervisors, (Houlihan, 2001). Callaghan & Thompson (2002) found three types of control. Technical control was managed by IS data collection, monitoring of CSR's and machine pacing of CSR's. There was normative self regulation by teams. Finally there was bureaucratic control through the use of limited scripts and appraisal and feedback based on standards.

The tendency to standardize call centres filters down to managers who also have to follow centrally determined procedures eroding their ability to manage locally, resulting in some managers being creative and breaking rules what others stay rigidly to them and some adopt a line of least resistance at the time, (Houlihan, 2001). Call centre technologies are a major source in the standardization of work practices, (Holman et al., 2007). While measurable quantifiable volume metrics were paramount in the final analysis management would 'periodically' move away from quantity towards the provision of a quality service and relax call handling times through this measure was always temporary, (Bain and Taylor, 2000).

Call centre managers may exercise their formal discretion and judgment and go against formal system requirements and the degree to which they and their staffs follow their job 'scripts' even where this leaves managers open to censure from higher levels of management. Call centre managers used 'workarounds' to do parts of their job such as staff development and mentoring employees because the organizational focus was on 'managing the [electronic performance LED] board', (Houlihan, 2001).

The managers decision to follow or deviate from formal procedures is affected both by the organizational context but more importantly by their 'individual interpretive repertoire', with the managers who struggled with the formal system had themselves worked as agents,

(Houlihan, 2001). Team leaders may not always enforce organisational rules but help emphasise and ease the tension of call centre work, (Deery et al., 2002). The tension between standardised procedures required to coordinate complex work and the ability to use workarounds was resented in PI-CORP. Department managers did not only rely on formal metrics but also informal discussions (as will be examined in section 6.3). Employees' work was not structured by very formal scripts though in developing fixes workarounds were widely used to get clients systems working quickly. Some of these workarounds were formalised in the knowledge solutions. As time was such a scarce resource, using their own 'interpretive repertoires' PSE's could bypass the longer more formal troubleshooting procedures to develop a solution. While the literature on call centres focuses on managers being reflexive and working when required outside the formal system in Pi-Corp this extended down to the employee level.

In the call centre the role of the supervisor became focused on monitoring rather than supporting, (Ellis and Taylor, 2006). In their telcorp case study Bain and Taylor (2000) found control was, for management, more relevant for surveillance with the practice of management more 'problematic' than (Fernie and Metcalf, 1998) allow when claiming employees call centres enable a 'panopticon' structure with perfect managerial surveillance possible. Taylor and Bain (1999) argue that the electronic panopticon view ignores the potential for employee resistance and found employees had various 'deviant' behaviours to influence the basis for and output of bonus calculations making the actual use of technology less than the electronic panopticon. Pi-Corp was interesting because apart from activities requiring physical intervention all activities were recorded yet 'deviant' behaviours existed from using fixes that officially, albeit temporarily, closed a case to cherry picking easy cases to improve performance metrics.

Despite references to the totality of control and the panopticon (Houlihan, 2001) argues that authors such as (Belt et al., 1999) and (Taylor and Bain, 1999) provide studies in which for call centre representatives monitoring was not a primary source of concern. Bain & Taylor (2000) found that the employees were not unaware of being monitored by supervisors and managers but based on their pattern of behaviour agents knew when they were being observed. Not only were case employees aware of being monitored by technology they were also aware of being monitored by those at an operational management level.

Like Graumann et al.(2003) the case management software PI-CORP did provide necessary information on customers but while it provided this information processing function as well as a control capability (using metrics) it did not provide, as the authors found, a coordination function in terms of an 'online lexicon' of scripts used to structure the 'total options' of client discussions. Rather an online taxonomy was used to define customer environments.

Unlike Bain et al. (2002) there was no remote monitoring of phone calls and though it was not a formal mechanism because novices were located physically close to their mentors the latter could thus engage in a degree of informal monitoring. Brannan (2005) found 'coercive control' in small CSR teams to reduce CSR's using 'wrap up time' inappropriately as this resulted in the rest of the team having to take more calls. In PI-CORP many PSE's reported that because of the small size of knowledge domain teams and an awareness of others' workloads employees ensured that they took their 'fair share' of the work, given their level of knowledgeability.

5.2.3 COACHING

Team leaders had the responsibility of encouraging a team spirit and encouraging interaction among colleagues to build a 'coaching culture' to improve skill retention, and also found that call centre employees who received social support from their colleagues and performance feedback felt more dedicated to, and less inclined to leave, the organisation, (Belt et al., 2002). Edwards et al. (2003) outline a 'craving for coaching' program in which each level of a call centre coached the level below it as a result of staff turnover reduced the amount of experience in the call centre. This resulted in reducing the number of customer complaints and sales per hour increasing and fewer errors occurring and retention rated increasing. In the case company the majority of coaching was within the same level through mentoring for novices and help giving to more experienced staff. Cases which could not be closed at Level 1 were escalated to Level 2 with no mechanism for feedback of the ultimate solution making learning more difficult.

5.3 KNOWLEDGE WORK

Gray & Durcikova (2005) provide four reasons why knowledge repositories are more successful in technical support than in other areas: (1) there is a narrow breadth of knowledge (2) there is a testable and specific end goal (3) those who create and use the knowledge are doing the same kind of job thus lowering misinterpretations (4) because many customers encounter the same problems the economic benefit increases with each reuse. All four factors were present in Pi-Corp.

5.3.1 ANALYSING CASES

To be successful technical support personnel need to apply a body of knowledge broader and deeper than the customers to the problems through this body of knowledge may be larger than any one employee's memory, (Gray and Durcikova, 2005). The problems found by technical call centre can be complicated both to understand and diagnose, (Gray and Durcikova, 2005). Call centre personnel operate in an environment of ongoing evolution of both products and services and the uses to which they are put by customers, (Gray and Durcikova, 2005).

Technical support personnel have to help solve customer problems in real-time with a limited understanding of the customers' situations Gray & Durcikova (2005) in the same way that employees must possess an abstract conceptualisation of the knowledge a customer requests even if that knowledge is not immediately available to them and, having beyond the limits of their knowledge, be escalated, (Adria and Choudry, 2002). In Pi-Corp employees possess general (common) knowledge of the hardware or software areas which is often sufficient to run a search for an existing solution. Even if the information is not immediately available to them, being outside their knowledge limits these can be extended or augmented by drawing on the knowledge management repository.

Call centre staff have three options when faced with a problem outside their knowledge (1) engage in a problem-solving dialog with the customer and try a number of experiments (2) escalate the problem (3) use external memory systems, (Gray and Durcikova, 2005). In PI-CORP though option (1) is initially tried customer understanding can be insufficient

leading to the use of the knowledge management system option (3), then seeking help from specialists in the problem domain which the authors do not refer to, and finally escalation option (2).

5.3.2 READING

While using a knowledge repository analysts learn about related problems and similar symptoms that have the same context and improve their ability to delineate the scope of the problem (Gray and Durcikova, 2005). This is particularly relevant to Pi-Corp and is discussed in detail in sections 6.2.2, 6.2.3 and 7.3.3.

By increasing efficiency repositories should be able to free up time for analysts to deal with more demanding problems by removing routine work, (Gray and Durcikova, 2005). Not only can repositories improve efficiency internally but they can also improve it externally by making knowledge solutions available to customers.

5.3.3 DOCUMENTING SOLUTIONS

Knowledge repositories are used in call centres to capture and reuse common solutions, with the objective of the call centre repositories to reduce costs, improve service quality and enhance analyst learning, (Gray and Durcikova, 2005). Brooke (2002) found a call centre biased towards tangible and technically orientated issues reflected in its standard methods with a tendency towards automation and a 'resource' view of information: it is a record of a physical resource that should be factually accurate. This depiction of the use of knowledge repositories was found to be accurate for the case company.

Call centre agents are horizontally interdependent of each other updating electronic repositories, (Adria and Choudry, 2002). Organisational responsibility is moderate as call centres are organised as teams the poor performance of a member will affect the unit's performance to only a small degree, thus even if one member does not update an organisational database routinely other employees make up for this neglect, (Adria and

Choudry, 2002). This problem also arose in the product support centre with only some employees adding and modifying solutions as analysed in section 7.3.5 on worker types.

Gray & Durcikova (2005) found there was little learning occurring through technical support knowledge repositories with analysts focusing on finding 'recipes' to customer problems rather than building their understanding of the products they were dealing with. In PI-CORP for standard uncomplicated cases finding a solution was sufficient; though even here some wider explanation was often provided that aided learning. In more complex cases with very context specific solutions a rationale was necessary and is covered in section 7.3.3.

5.3.4 AGENCY

The ideal design of a call centre is decentralised decision making with centralised control as call centres require decentralised decision making because customers require real-time decisions, (Adria and Choudry, 2002). The level of abstractness of call centre work is high as employees must make a cognitive commitment to a practical situation and through decision trees and templates are provided employees must decide on the actions necessary for a satisfactory outcome, (Adria and Choudry, 2002). The migration to call centres by British Gas (97-99) led to a deskilling of work with speed and efficiency being highly valued replacing previous attitudes of 'knowledge' and 'professionalism', (Ellis and Taylor, 2006).

Unlike Holman et al. (2007) who found that managers reported agents as having relatively low job discretion with relatively few chances to exercise independent judgment, PI-CORP required PSE's to exercise high levels of agency and knowledgeability in their work and a knowledge management system was used to increase speed and efficiency, rather than deskill, it served to deflect standard work increasing the complexity of the remaining work while also aiding learning.

5.3.5 WORK PRACTICES

Working ‘on the phone’ all day was found to be repetitive stressful and tiring by employees, (Belt et al., 2002). PSE’s had the option of alternating between working on the phone and taking cases from the work queue. Because the latter contained larger number of standard calls phone work being more intellectually demanding and random was seen as a way of providing a break for the novice PSE from the computerised queue.

Customer support reps would have to follow a scripted interaction with customers based on a flow diagram depending on answers- primarily logging calls correctly, (Brannan, 2005). A paradox is that while telebank call centre employees were recruited based on personality the company then seeks to control how employees act out by using ‘scripting’ for conversational control, (Callaghan and Thompson, 2002). Call centres are *‘heavily normed following a deeply embedded script’* Houlihan (2001) leaving the customer sales representative little flexibility to negotiate their interactions with customers so tightly are these encounters scripted, (Deery et al., 2002). The use of scripts is a qualitative transformation of managerial attempts to control white collar workers, (Taylor and Bain, 1999). Indeed in the case of Kinnie et al. (2000) quality standards were developed to monitor the scripted call structure. In PI-CORP technical skills were predominant with an advantage that the client had a degree of common knowledge: scripting was not used as problems were specific and depended on how the PI-CORP products were implemented by the client.

5.3.6 PARALLEL WORK

Medical call centres engage in ‘telephone triage’ which involves multitasking by listening, recording, as well as interpreting patients symptoms then assessing the nature of the problem and recommending appropriate actions: this must be done while coping with the distractions of more critical patients, (Leung and Mao, 2004). This was a constant issue in the product support centre with managers engaging in triage by monitoring the case queue as well as assessing the priority of some phone calls and alerting specialist groups that a high severity case had arrived. While individual PSE’s would also monitor the serious cases some may not be identified as PSE’s worked on multiple cases simultaneously. This

was similar to Adria & Choudry (2002) who argue that call centre employees must change the context of their work from moment to moment, though typical call centre work consists of a series of short telephone interaction while the case company work involved a variety of long and short duration cases interwoven simultaneously over a time. These issues are considered in more detail in section 6.1.4 dealing with customer interaction.

A challenge in many diagnostic tasks is to consider the full range of possibilities which can be difficult in medical situations because of an ‘explosion’ of medical knowledge, (Leung and Mao, 2004). There was also a wide range of possibilities available in Pi-Corp: their management was supported by the knowledge management repository which could both suggest additional solutions or filter irrelevant possibilities from the PSE.

Gray & Durcikova (2005) found that analysts in call centres did not feel the repository was a resource to enable them improve their knowledge, skills and abilities with those who cared least about learning new things using the knowledge repositories most. The authors posit that this is because the repositories contained ‘procedural knowledge’ which outlined solutions without providing our rich description of why are how the problems occurred or how it should be understood. Because of time constraints PI-CORP employees tried to use the knowledge repository to find solutions to problems they did not tacitly possess. However the solutions in the knowledge management system contained rich description in the form of rationales. The issue of rationales is analysed further in section 7.3.3.

5.3.7 LEARNING

Behavioural strategies include: interpersonal help seeking with help the being obtained from others; seeking help from written material and practical application which involves trying things out in practice, (Holman et al., 2001). Cognitive strategies include: reproduction/ rehearsal where information is reproduced without reflection on its meaning the organization when learning comes from identify key issues, and the creation and grouping of elements learned; elaboration where the implications of new information are examined so as to understand new information given existing knowledge, (Holman et al., 2001). Both these strategies existed in Pi-Corp in the form of mentoring and help seeking as examined in section 6.3.

5.3.8 REPUTATION

The main responsibilities for call centre staff are ‘reputational’ with poor performance damaging the company’s reputation and ultimately losing business, (Adria and Choudry, 2002). Not only were product support employees concerned for the organisation’s reputation: they had a norm of assuming any problem was the companies fault until they could prove differently. Reputation was also important at an individual level as discussed in section 7.3.4 where similar to (Levitt and March, 1988), (Davenport and Prusak, 1998) and (Zack, 1999b) quoted in Gray & Durcikova (2005) the use of authors’ names in repositories as acts as an important quality signal.

5.4 CONCLUSION

This chapter reviewed the relevant literature on call centres. It outlined how they are structured as well as details of the work undertaken. Reference was made to Pi-Corp (about to be described analysed in chapters 6 and 7) by drawing initial comparisons and contrasts with typical call centres as described in the literature.

Differences include the case company:

- Being more technical, dealing with more complex work.
- Dealing only with other business, rather than individuals as clients.
- Having high employee retention.
- Requiring a higher depth of technical knowledge (a degree or a number of years relevant experience)
- Not only deal with customers over the phone but also taking remote control over parts of their clients’ information systems.
- While agency was seen as central to knowledge work (section 2.5) it was typically circumscribed as much as possible in call centres where attempts to standardise work processes had the effect of deskilling work. The ability for employees to exhibit agency in a structured (Level 1) call centre proved to be a key theme.
- Employees in Pi-Corp engage in work practices that are less scripted than most call centre workers.

- Interactions, in the case company, tended to be computer mediated than more directly via telephone. Often interaction is with the clients' systems directly than with clients' staff.

Similarities included:

- Information technology being used to support client calls is similar to most call centres making heavy use of ICT's and ACD telephone systems.
- Given the technical nature of the problems to be resolved coaching new employees became even more central as considered in section 6.3.
- Like other call centres, using ICT's, work was conducted in parallel. In Pi-Corp incoming problems were prioritised with an emphasis on work allocation and the order in which it was performed.
- Reputation in the call centre literature tended to centre on employees work affecting how their company was perceived. As will be discussed in section 7.3.4 in the instance of the case company not only was external reputation important but also exhibited internal issues around reputation.
- Having considered the call centre literature, indicating the areas to expand upon in the thesis this chapter provides a link between the secondary and primary research undertaken.

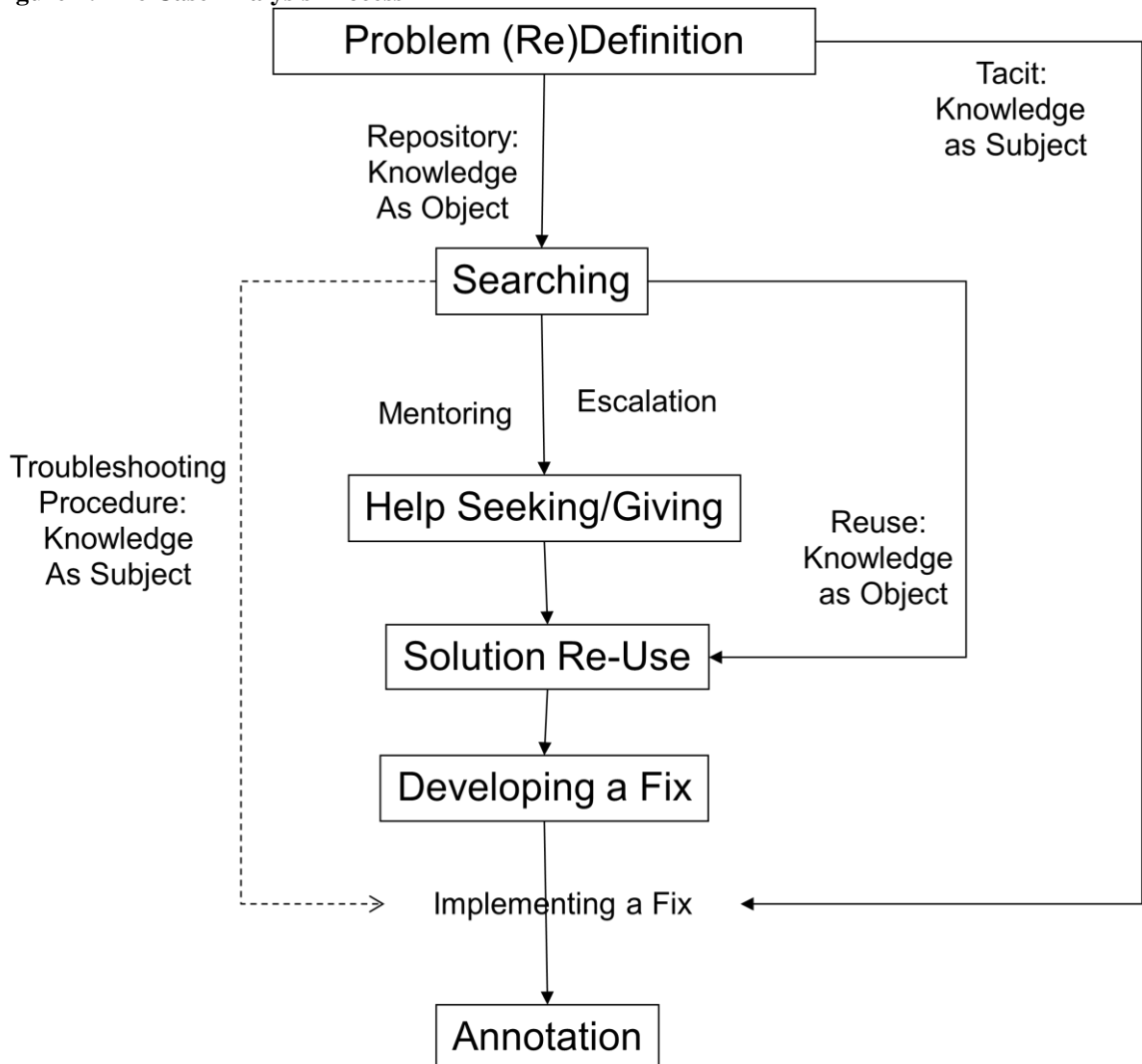
The two main activities, analysing cases and documenting solutions, undertaken by case company employees are considered in the next two chapters.

6 THE CASE ANALYSIS PRACTICE

This chapter will describe the steps to be taken by employees when analysing cases. All Product Support Engineers are involved in this activity. This is the core work of the two departments and occupies the majority of employees' time. The main parts of this process are outlined in

Figure 4.

Figure 4: The Case Analysis Process



The first activity (6.1) involves defining the problem. This may be tacitly available or may require the employee to assess the initial information available on the problem, held in a range of corporate information systems. Gathering initial information may also necessitate

contacting and interacting with clients' technical support staff to gain access to additional files. Because problems can appear similar but require different fix procedures the objective of this step is to adequately define the problem.

Having defined the problem PSE's search (6.2) the repository for an existing solution. A key issue in this search is the context specificity of the problem. Clients may have similar problems but slight differences may make an existing solution unusable. If an existing solution is applicable then an employee may use the steps outlined to fix the problem. This ensures Level 1 employees have the opportunity to solve relatively easy cases while ensuring time was not wasted on more complex cases that required more specialist skills. While attempting to resolve a problem at Level 1 an employee may seek help (6.3) from another employee at the same level with greater knowledge of the particular problem.

The employee may be able to re-use an existing solution (6.4) located within the knowledge management repository. Where no existing solutions are applicable or cannot be reused in their current format an employee may seek to develop a new fix (6.5) to the problem situation. These fixes may resolve the problem with no reoccurrences or may be sufficient to allow the case companies hardware and software work for long enough to enable further analysis. Because employees' productivity is closely monitored they are only allowed a certain amount of time to assess, develop and implement a fix.

Some cases remain open for an extended period of time. As well as taking the above steps to analyse cases, in this situation employees will keep annotations (6.6) of their work on the case, to help when they return to the case. The chapter ends by outlining important themes from the preceding analysis of the case analysis practice.

6.1 PROBLEM DEFINITION

Once cases enter the case management system they are allocated to specialist work queues. PSE's can view these cases' details when selecting the case to analyse. When the problem context can be defined with certainty its resolution process can be automated.

An important part of the PSE’s work is when this is not possible and the problem must be defined.

“Yeah, I mean we could sell a product to 10 different customers but everyone of them would use it differently, cause our products will allow that, so you may resolve an issue today that’s unique to the customer and write out a [Repository] article on it but it may not be suitable again for the other 9 customers because they’ve the same issue but it manifests itself differently and your solution may not apply...you can’t say oh try this, it worked for me yesterday and that customer will try it and say no it doesn’t work.”

Software Manager

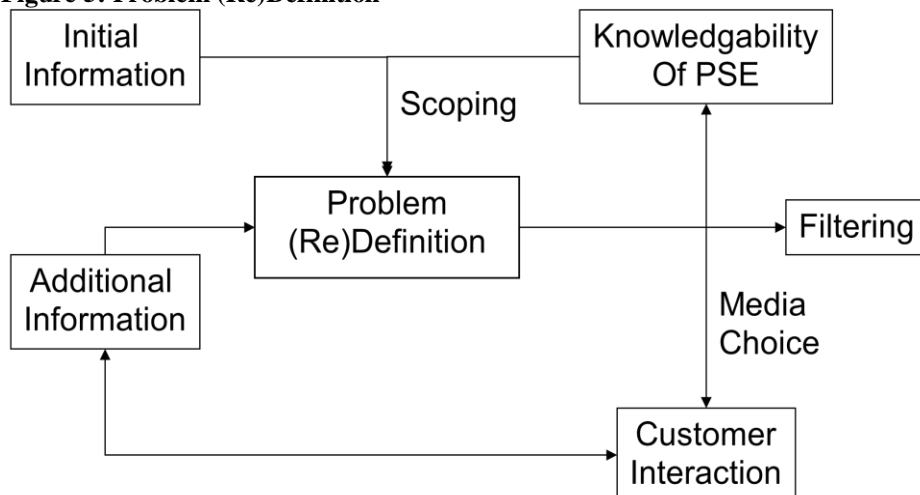
Two cases may exhibit the same errors but require different solutions to be applied because of differing client configurations. It is important that the problem is viewed in terms of the sequence of errors and the context in which they occur. For this the PSE draws upon their know-how and know-when. This can be augmented by available sources of information.

“[a case] opened by a customer or by a web call are a bit like a phone call, no information about the box, not a lot about the correct modem information about the box you don’t know anything about what’s causing the problem for the customer, it could be a software problem but you’d have to rule out hardware because you don’t see any problem and you don’t event codes logged that doesn’t mean the hardware’s ok.”

Experienced PSE

This reiterates that this is knowledge work as outlined in section 2.5 because it requires employees to work with knowledge and use their intellectual capacity to apply that knowledge to a particular context. The main elements of Figure 5 will be examined in detail in the following sub-sections.

Figure 5: Problem (Re)Definition



6.1.1 INITIAL INFORMATION

The initial information available to PSEs when analysing a case come from a number of sources. A Primus solution is structured into six sections as detailed in Table 5.

Table 5: Sections of a Primus Solution

Primus Section	Description	Knowledge Type
Goals	The actions performed and documented in the fix	Know-how
Facts	Clients configuration using terms in the ‘environment tree’ to specify the case context	Know-what
Symptoms	Describe problem characteristics and are objective statements detailing occurrences	Know-what
Changes	Changes instituted or attempted by the client	Know-what
Cause	Links symptoms (effects) to actions (changes)	Know-why
Fix	Outlines the procedure to follow and involves explicitly documenting the sequence of actions taken	Know-what

A solution begins with a goal section that outlines what the solutions does. Facts provide details of the hardware and software environment for which the solution is appropriate. This ‘facts’ section allows problem contexts to be defined as discusses in section 6.2.2. Symptoms may include the error codes (Figure 6) and error messages that were logged when a problem occurred as well as a PSE’s own description of the effects of a problem. The changes section describes recent changes such as client software upgrades that may have caused the problem. Changes may also include the changes made by a client that precipitated the problem.

Figure 6: Error Codes

Root Cause: A disk was inadvertently removed from the server by unmapping it from the FA ports. The disk will go write disabled (error 19) first from the unmap operation and will then go not ready (error 21).
 Fix: Map the disk back to the FA ports.

The AVATAR system contains details of third party products used by clients in conjunction with case company products. In addition to technical data (know-what) AVATAR documents are similar to Primus solutions having in codified form ‘know-how’ and ‘know-why’ and existing in a ‘finished’ format. ‘TECH2’ documents are work in progress papers from the (higher) Level 2 support departments. These documents become more objectified over time to ultimately represent ‘justified true belief’ on a problem. PSE’s own case annotations (section 6.6) may also be seen as ‘work in progress’ knowledge objects as they facilitate the arrival at ‘justified true belief’ but may currently contain unjustified hypotheses on a problem. In the latter two cases the knowledge-objects enable readers to see the current provisional state of knowledge but do not contain the finished knowledge-product. They are knowledge-buffers which hold work in progress with the final product held elsewhere as documented code and as Repository solutions. From a firm perspective, the ultimate aim of such documents is to enable the justification of the knowledge they contain to enable efficient knowledge re-use.

The customer support website or customer support technician telephone helpline use a standard case creation form which structures the incoming problem using templates and also use an organisational taxonomy to categorise the case. This requires the tacit knowledge of the client and customer support technician as well as the organizational taxonomy to produce a document that enters the case management system. In less defined problems it is a prelude to client and PSE tacit to tacit transfer of information about the problem as it is subsequently refined.

The preceding descriptions of the available information systems suggest a knowledge management strategy that is heavily reliant on creating objective knowledge asset categories within specific knowledge domains that can be leveraged through re-use. This strategy is supported because knowledge about problems relates to empirically observable facts. An objective of the traditional perspective is to make knowledge available to PSEs in a timely manner. Because other departments work-in-progress is documented these knowledge objects are also made available to PSEs. However availability does not necessarily equate to understanding.

Concepts from the practice-based view can also be useful in this situation. Rather than seeing the meanings contained in knowledge-objects as objective they can usefully be considered as current in the context in which they were originally written and involve PSE's making and remaking perspectives on problems as the underlying knowledge domain changes. Access to these various forms of information system illustrate an asymmetry of power among product support workers. Initial information both enables workers to diagnose and solve problems but also constrains them (1) by limiting their access to certain information that exists in the organisation and is relevant and (2) because of workers own interpretive schemes.

"I would say the trouble shooting/solution process is where we have to keep going back to the customer maybe getting further information. Maybe start off initially asking what's the problem, what's the software that you're running on your PC, the maintenance level so you're getting all the up front stuff as much as you can...we know kind of where it's going but we don't know exactly where the problem is so you might have to ask them to do further displays so you get further information from them and again you might have to go back to them again looking for further ones that would be more in-depth ones where they might have to try to recreate the problem"

Novice PSE

6.1.2 GENRES OF DOCUMENTS AVAILABLE AS INITIAL INFORMATION

Initial information is communicated to PSE's in many forms that may be conceptualised as communicative genres drawn upon at the early stages of the case analysis practice. Interview and document analysis identified eight communicative genres used in the product support department. These were analysed under the same six headings as used by (Orlikowski and Gash, 1994) and are presented in Table 6

Table 6.

From the practice-based view 'finished' and 'draft/provisional' documents need to be handled differently due to the interpretative nature of the meanings involved. In considering communication among communities of knowing (Boland and Tenkasi, 1995) argue that the conduit model (Shannon and Weaver, 1949b) is best suited to communities where issues are clarified as is the case where a strong perspective has been made. In 'questioning perspectives', Wittgenstein's language games are more apposite with

meanings enacted in situated actions, as when documents contain current thoughts on a perspective.

Table 6: Information Sources

	Dial-Home	Website-CST	Phone Call	Clarify
Purpose (why)	Error Identification	Document Fault	customer- get help- PSE- need information to offer help	Coordination & Management of Work
Content (what)	Error codes- time stamp- client ID	error description- categories-text - client details	(structured) conversation on problem	Case management data-structured & annotations-unstructured
Participants (whom)	PSE- Recipient Engineering-indirectly in writing code to generate	PSE- Recipient, CST & Client create	PSE & Client	Created Automatically, Amended by PSE
Form (how)	structured to return error codes, times, client ID	Database form-elements such as error may be textual description	over phone- series of questions and answers	Database form-structured and non-structured elements
Time (when)	triggered in defined conditions- as needed	As problems become visible to client	As problems become visible to client	Automatically Generated by Dial-home, Web/CST form or created as part of Phone call
Place (where)	created at client-forwarded to firm	Client Contact information-location of equipment. CST form electronically sent to Clarify.	Equipment address relevant. Contact information.	Location of Client & Equipment.

	Avatar- 3rd Party	Technical Advisories	TECH2	Primus Solutions
Purpose (why)	Provide details of products	Proactively avoid cases/problems- Deflection	Coordination of work	List of actions to resolve defined problem
Content (what)	PDF's- white papers- product manuals	Structured documents outlining potential problems and how to avoid/solve them	semi-structured open issues in engineering	problem details- configuration- solution- rationale
Participants (whom)	3rd Party Vendors write, to be read by PSE (technical staff)	Written by: Engineering, For PSEs and clients	Written by and for Engineering. Available/visible to PSE's	Written by an for PSE's
Form (how)	Detailed outline of product version, features, known issues.	Description of potential problems. Technical but written to be understood by PSE's & Clients	Description of current 'open issue/problem' technical, may assume knowledge of software code	Database form: structured and unstructured elements
Time (when)	Available with product releases.	Created to deflect cases when patch/solution available.	Continuously updated as by-product of work	Should be created after novel case solved.
Place (where)	Multiple locations.	Written in one location for internal and external locations.	Created & Used in one location but visible to another	Created in one location, can be fully/partially made externally available

The engineering department has the ability to write and modify the monitoring software source code giving them interpretative flexibility to define problems. Tech2 documents are the engineering department's work in progress documents and are later written more formally as 'technical advisories' for lower levels of support as meanings become more clearly defined. They are the manifestation of this department's perspective-making activity.

When reading TECH2 documents Level 1 PSEs may gain insights and new meanings but also need to understand the limits of their own knowledgability to access another set of interpretative schemes even within a narrow knowledge domain. The Level 1 PSEs engage in perspective-taking when reading current drafts of TECH2 documents. This involves trying to overcome the differing structures of signification that exist between each department's stocks of knowledge.

This is less problematic with technical advisories because they represent a more complexified and developed understanding of the underlying problem. Technical advisories are written to inform other departments of the status of current issues in the engineering department. As such they are written with other audiences in mind and seek to allow others understand the engineering department's perspective. They provide current documentation on the emerging perspectives, and are written with consideration for the interpretive schemes of others.

6.1.3 KNOWLEDGABILITY OF PSE

(Tsoukas, 1996) is critical of classification schemes because categories are rarely stable with discernible systematic differences and similarities. This is less a problem in Pi-Corp. The relevant objects (solutions) sought to document problems and issues for which objective facts regarding similarities and differences can be determined (Facts, Environment, Symptoms, Problem, Change) and documented procedures (Fixes) can be proven to work. Also change, though present, is incremental. Given the repetitive nature of some cases PSE's will be familiar with a high proportion of cases and tacitly aware of their solutions. The tacit knowledge drawn upon refers to a particular domain. In the case of software support the knowledge domains relate to specific types of server as well as operating systems, how proprietary software interacts with vendors' operating systems and a third party applications, as well as networks. From an objectivist perspective this tacit knowledge should be codified to automate the removal of repetitive cases. When a case must be checked reliance on PSEs' tacit knowledge is the most efficient way of doing this, with documented solutions acting as a back-up mechanism.

That '*the application of rules cannot be done by rules*' Gadamar (1980:83) is quoted by (Tsoukas, 1996) in arguing that agents' understanding exists implicitly in the participation of a practice rather than only tacitly. To understand how knowledge is shared between communities it is necessary to understand the distribution of power among them, (Seely-Brown and Duguid, 2001), particularly when as (Crowston et al., 2001) found that different meanings existed among groups.

The type of work undertaken by each department (Level 1, Level 2, Engineering) varies in novelty and difficulty. Organisational norms regarding resource efficiency necessitate the formal specialization of labour by knowledge domain teams. Group norms also exist to facilitate further informal specialisation within knowledge domains. Over time, due to the more complex work they have been allocated, the engineering department develop more complex interpretative schemes than Level 1 support. They have the highest level of interpretative flexibility in integrating with the company's products is greatest in the engineering department. Least interpretive flexibility available to Level 1 support who must interpret physical and virtual errors that can be seen as signifiers coded in the software. The majority of Level 1 PSE's time involves closing known, standard problems.

This means that the existing structure of domination reinforces structural differences between levels of workers. The signifiers interpreted at Level 1 are best understood, most defined and least open to interpretation. However, as will be argued in this thesis even Level 1 PSE's exhibit knowledgeability and agency in this seemingly structured environment.

Individual knowledgeability is developed in the day-to-day case analysis practice. In the two departments examined informal specialists acted as boundary spanners to enable the transfer of new emerging knowledge that is different to transfer out of a community. The actors transfer knowledge between a particular knowledge domain and others at their level. When a case becomes too difficult for Level 1 support they can request a Level 2 support person to visit the lab to help them. The Level 2 operative has higher knowledgeability and can transfer this during interaction with the Level 1 PSE through analysing the problem with them. As the perspective on a problem becomes more defined documents can replace humans as boundary spanners because the interpretive schemes they convey are more widely shared and understood.

The value of documents (6.1.2) and higher level assistance to help analyse cases is bounded by PSE knowledgability. PSEs can increase their knowledgability but are constrained on a practical level in three areas. First, they are determined by metrics and work norms which limit the time available to take relatively novel cases. Secondly, they are determined structurally by the lack of access to the source code resource and thirdly, cognitively by a lack of sufficiently similar interpretive scheme with the boundary spanning agent or object.

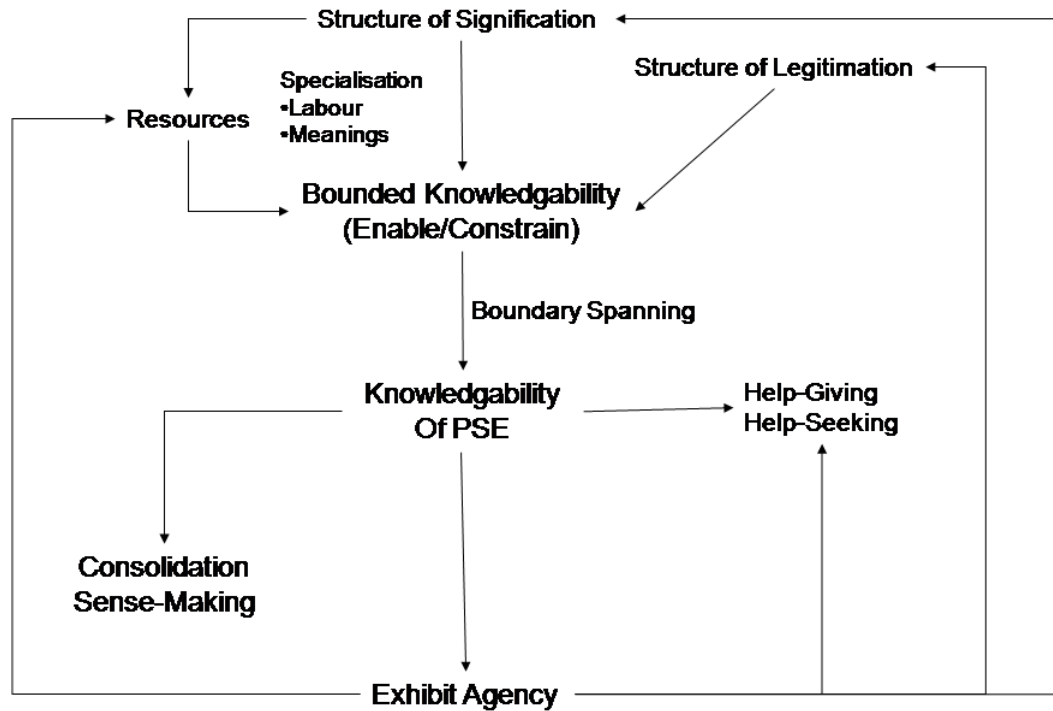
Initially PSE's exercise agency by interpreting available information. This involves scanning texts and focusing conversations with clients' staff to identify errors so as to contextualise material. To do this the PSE must possess a requisite level of knowledgability to identify what in the current problem is relevant. This knowledgability is facilitated through the development of their interpretative schemes regarding the meanings error codes have in various contexts.

Similar to (Bloor and Dawson, 1994) employees in Pi-Corp also draw on computer mediated schemas to build and amend their own stocks of knowledge on a problem domain in order to select appropriate responses. In this case the electronic representation of events does not, as asserted by (Weick, 1985), suffer from a loss of meaning and flawed data. The limited processing capacity of individuals is relevant but different from Weick's (1985) description. Individuals' information processing capacity is not constrained due to insufficient information. In Pi-Corp employees can access electronically represented events. Their processing capacity is constrained not by the lack of electronically available information but rather by existing information not being made available to them at their level as well as their lack of capacity to process the available information.

Problem analysis in the case company can involve the sense-making concept of 'consolidation' as outlined by (Weick, 1985). PSE's need to think beyond the specifics of a particular case to see a wider context to make adequate sense of the case that requires a different "order of logic". However, while (Weick, 1985) argues this wider consolidation requires the actor to move beyond the information system, for PSE's the information is contained completely within information systems. Though they may need to go beyond

the specifics of available solutions. Their consolidation is bounded by the context specific logic existing in those solutions.

Figure 7: Knowledgeability



6.1.4 CUSTOMER INTERACTION

A particular case maybe repetitious for PSE's but new for their clients' support staff. Pi-Corp provides product support training for a number of clients' staff who are then designated to act as primary contact points. PSE's often need to question clients' staff in order to refine the problem while maintaining a professional image to external parties. This can be complicated where the PSE can see details on a repository solution that is not available to the client viewing the same solution. This is because of a system enabled feature called statement level security (SLS) discussed later in 7.3.2. Read privileges are based on various categories of users in a hierarchy from the engineering department down to customers. Each statement in a solution can be set to be viewed only by those at a certain level or higher. This hides certain solution elements from lower levels, particularly customers where the information may be damaging to the firm's reputation. The PSE must

seek relevant information from the client while not being able to explain the reason the information is required.

Customer expectations of legitimate actions are officially defined by service level agreements with Pi-Corp. Even though customer expectations are formally legitimated, customers seek to test these boundaries by requesting additional legitimated help on this and other non-related issues when interacting with PSE's who must decide when it is possible to provide this help.

When defining the problem PSE's may engage in social interaction with clients' technical support staff as well as their own customer service engineers (CSE's). One or both of these groups will have already been involved in the case and so this interaction provides an opportunity for these groups to provide PSEs with their perspective on the problem. This perspective involve meanings are developed by customers' support staff. They are developed during training, previous interactions with PSE's as well as through access to solutions on the customer support site. These meanings are also structurally bounded because customers' staffs are not permitted access to defined parts of solutions limiting the amount of knowledge to which they have access.

It is important that the PSE can gauge the knowledgability of clients' support staff as this helps them engage in perspective-taking. By doing this they will later be better able to explain to customers what has occurred in a way that is likely to be understood. (Pawlowski and Robey, 2004) found that what they called a brokering practice not only required 'translation', the framing of one community's view in terms of the others worldview but also required the explanation of the relevance of translation to the recipients practice. To improve another's knowledgability perspective-making and perspective-taking enable gaps in meanings around a case to be closed. This is different from (Christiansen, 2006), where differing meanings were negotiated. In this research context one party holds an underdeveloped meaning. Unlike (Pawlowski and Robey, 2004) translation did not require participation in the user's community to understand the clients use of the firm's products. By not only 'translating' but also interpreting and evaluating problems and solutions PSEs added value to clients by avoiding potential future problems and improving clients' use of the case companies products.

6.1.5 INTERACTION MEDIA CHOICE

Where a problem is ambiguous it may require a tacit-to-tacit information transfer over the phone with the clients technical support staff in an effort to more precisely define the problem. PSE's found that they were able to gauge support staffs' understanding of the problem during initial phone contact. This affected subsequent interaction and the level of help sought. In some cases the time taken to close a case was decreased where client staff reading of previous solutions let them proactively gather the information needed by PSE's. See Figure 8 for an example.

Figure 8: Solution Outlines Information to be Gathered by Customer

Fix:

In order to minimize the overall Service Request resolution time we strongly recommend that the following information is provided and logged to the Service Request. The information will enable our Support Engineers to deal with your request in a more effective and timely manner. Please cut / paste questions plus responses into the Service Request. Provide a detailed problem description that includes symptoms, error codes, error messages, and/or screen captures:

At what stage did the problem occur i.e. during a full backup, incremental backup, non-DAR restore, or DAR restore?

Was backup on a checkpoint file system or Production File System (PFS)? If it was on PFS, were files being accessed while the backup was in progress (e.g. file deletion, file manipulation or file creation etc.)? ...

If clients' staffs were not perceived as adequately knowledgeable or if there was a language barrier information was requested in written form using a chat feature or by e-mail. Alternatively, where permissible, the PSE can take remote access of the client's system.

Rules of signification enable and inform the communication process, (Orlikowski and Baroudi, 1991, Orlikowski, 1992). An issue raised by PSE's during this research was that, where English was not the native language of client support staff, their ability to communicate in a written format was better than their verbal ability. This made text based computer mediated communication more comfortable for the client. The client may have sufficiently different meaning structures from the PSE that could potentially cause misunderstandings. This could stem from a lack of linguistic ability that could be compensated with time and written rather than instant oral interaction. Alternatively

misunderstandings could be due to or a specific lack of understanding around the meanings associated with problems and associated error codes.

PSE's can be seen to take aspects of other written genres and apply them to other areas, transposing rules from one technology mediated situation to another. The fact that actions were already highly visible with each keystroke recorded, meant that PSE's developed practices that ensured their client interactions were also visible. They saw this as providing them with more protection than exposure. The structure of the written interaction also provided a level of formality and control.

6.1.6 PROBLEM (RE)DEFINITIONS

Initial information about a case could precisely indicate the underlying problem, for example where an error code or client description had one possible meaning. More difficult cases involve a series of errors occurring over time where a confluence of issues leads to the problem. Error codes can be ambiguous and have different meanings: they may indicate different underlying problems depending on the case context in which they occur. The company can respond to this complexity in a number of ways.

“If you dialled in there could be maybe two dropped in different directions you know, they're totally separate it could be a number of different issues like there could be or kind of you know what is connecting our drives together.”

Experienced PSE

Taking the traditional knowledge management perspective the organisational error code taxonomy can be made increasingly more precise by increasing the number and specificity of error codes to identify more situations. This enables the more efficient categorisation and locations of solutions.

“in sym6 you'd have more modifiers you've got the error codes with the modifiers nowadays which mean a lot more than in sym 4 and sym 5. So again, their Primus solutions have all the different modifiers within those solutions now as well.”

PSE

Part of a PSE's tacit knowledge may be 'technical tacit' (Alavi and Leidner, 2001) which is procedural know-how relevant to specific work. Another element termed 'cognitive tacit' (Alavi and Leidner, 2001) involves a PSE's mental models regarding problem causes and how these are manifested as symptoms of problems. Both of these are context specific. These are built over time through training and experience of cause-effect (error-problem) relationships and their contexts.

If a Level 1 PSE doesn't tacitly know or cannot identify an appropriate solution to a problem within a short period of time they are required to escalate the problem. This escalation can be to another PSE in their department or to a higher support level of product support. For very well defined contexts the process has been automated with the only action required by the PSE being to initiate a pre-populated search with error codes that returns a specific solution. Automation also involves running scripts to correct known and recurrent problems. The balance to be struck from a traditional perspective is between the costs of codifying PSE knowledge given the pace of change of the problem contexts and likelihood of recurrence as against allowing only PSE tacit knowledge.

From a practice-based perspective it is about using agency to keep an evolving problem domain up-to-date by assessing current problems against the existing perspective. PSEs daily engagement in this practice allows them to identify if meanings are new and whether they are worth documenting. The more ambiguity i.e. the more possible meanings that could exist regarding a problem, the more work the PSE puts into refining the problem. They must develop hypotheses regarding possible causes supported by the available facts from multiple meanings based on problem error codes before them. This may all be done while simultaneously discussing the case with a client and reading available information, from multiple sources, on multiple computer screens.

“there's an awful lot of complications like there might be showing up one error but the problem is actually caused by a different error and it takes a lot of investigation but it's definitely easier, that it might give you a head start mainly. It will rarely kind of, fix the problem but it will give you a basic look at a solution that applies to the certain error... you can get the same error code and it can point to, it can be caused by a lot of different reasons you know, kind of where our investigation would come in.”

Experienced PSE

6.1.7 FILTERING- CASES OUTSIDE BOUNDARY

For the majority of problems the cases management system allocates cases to an appropriate knowledge domain work-in-progress queue. This reinforces the specialisation of labour in the product support department. This system also categorises the priority of cases from 1, the most severe category, to 9 the least severe. Experienced PSE's are expected to take any high severity cases they see in the queue, but may only work on one high severity case at a time. When none are available they are expected to take the oldest medium severity cases in their domains work queue.

Phone calls involve less the defined problems. A customer may ring saying that their system seems to be running slowly. Because of the generality of the initial problem description it can be difficult to assign the problem to a specific hardware or software domain.

“Yeah, to be honest like the Primus is not great for the phones ... It's cases where they call in and they'll say the customer's complaining about logging something on a mainframe console and he wants you to look through the box and you're trawling through it and it's like looking for a needle in a haystack really you know. The Primus and stuff is no use really you know.”

Novice PSE

It is possible for cases to be allocated to the wrong department. An apparent hard disk failure may be allocated to hardware for the cause to be later discovered as a software problem. PSE's will filter calls that are for another department from their work queue as a natural consequence of the organisational standardisation of labour. Where the case is less specialised or not initially specified in detail, typically when answering a client call PSE's are expected to work the case once it is within their departmental boundary.

Figure 9: Non-Event

Root Cause:

When an event on the backend loop causes a loop initialization protocol (LIP) process (such as when a drive shuts down, or is replaced), the backend loop will put all its drives through "loop discovery." This means that all disks on the loop will transition through many states of logging themselves out then back in again. Since this could potentially mean hundreds or thousands of messages in the storage processor (SP) event log if every disk state change was logged, Base Software does not log such messages.

Fix: There is no "fix" for this issue because the messages are expected behaviour.

Novice PSE's should close cases they find straightforward while initially 'learning the ropes'. A number of these cases may be what are termed 'non-events' i.e. an error is logged but the system is running satisfactorily and the error does not re-occur (see Figure 9). There is an expectation that a PSE would close any standard cases even those outside their own knowledge domain where a solution exists. For more difficult cases, rather than formally escalate a case they will seek help from an informal specialist in the department, as outlined in section 6.3.

The knowledge management manager likened novice PSEs as akin to general practitioners treating patients with standard ailments but able to identify patients who need to be referred to a specialist. Even though Primus solutions are highly structured, to confirm a solution is appropriate, a shared interpretive scheme is required between writer and reader. Interpretive schemes may be enhanced for the reader by a rationale being provided within a solution. The lack of a sufficiently developed interpretive scheme in new PSEs can lead to two problems. First, they may believe a 'non-event' is serious though insoluble by them and seek help. The cost of this is to take up the time of another PSE for a 'non-event'. Once such a case is resolved it develops (complexifies) the meanings a PSE has on that problem. Secondly, and with more serious consequences, because they may not possess sufficiently developed knowledgability a new PSE may incorrectly categorise and close a case as a 'non-event' which later affects a client. While important that PSEs define their job in terms of the central work of analysing and solving cases, they must also develop a broader understanding of their role.

Intra-community communication and coordination may break down (Seely-Brown and Duguid, 2001) where there is a low degree of similarity between 'embedding' and 'disembedding' conditions (Giddens, 1990). PSE's need to be careful that they are sufficiently au-fait with the problem domain to understand the full significance of solutions. Due to their degree of specialisation PSEs understandings of meanings 'shades-off' outside their particular knowledge domain. These knowledge domains are reinforced by system resources such as specific work group queues and work allocation procedures. Within the hardware and software departments there are a number of specialist teams. Where cases are sufficiently categorised (and categorisable) they are allocated to specialist teams by the case management system.

Figure 10: Knowledge Domain Boundary Issue

Root Cause: Causes and resolutions: Event ID 333 can be hardware or software issue.

Software issues: Some anti-virus and backup software may cause this event. Disable suspect software. Or use msconfig to remove the software form the startup. ...

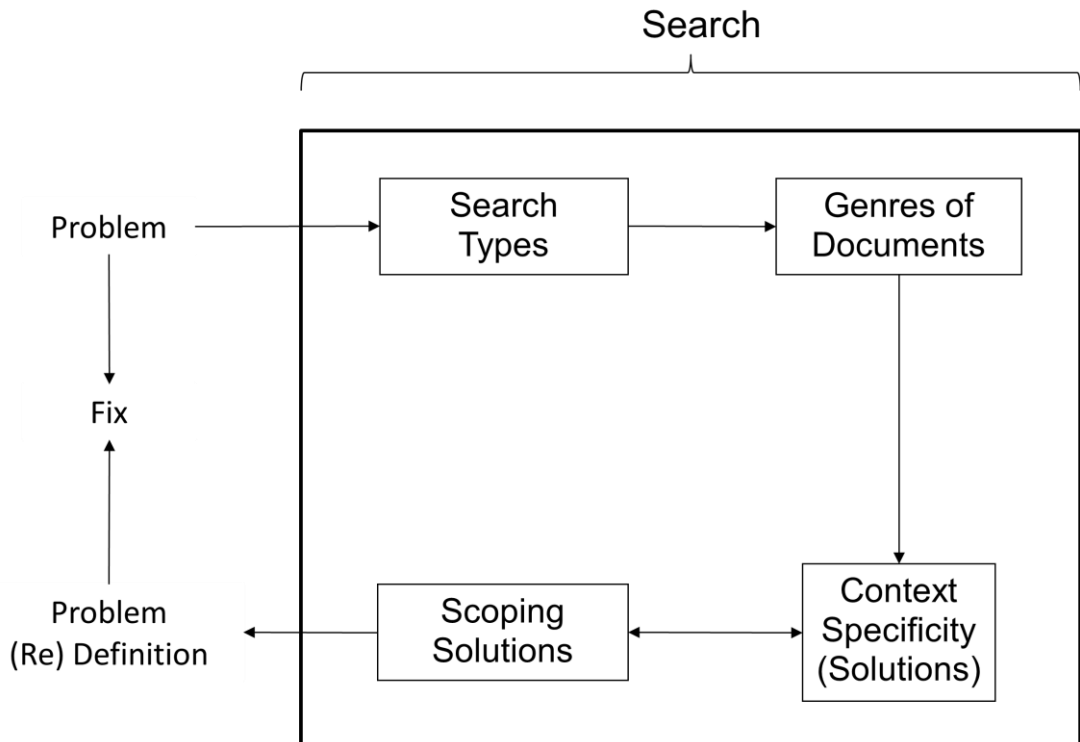
Hardware issues: It can be NIC issue. Try to reload or upgrade the NIC driver... All the following should be checked against the host...

Though information systems sought to categorise knowledge and allocate it to specialists this was not entirely successful. PSEs informally corrected this by reallocating work to avoid dealing with poorly understood meanings from other specialist domains.

6.2 SEARCH

The use of a standardised taxonomy of error codes and environments facilitates the automated search feature. Typically hardware and some software areas are seen by PSEs as ‘black and white’. In such cases these PSEs view Primus as very valuable because of the precision of its searches.

Figure 11: Searching



While the knowledge manager's view is that: *"When Primus is searched the solution, if it exists, should be found in the top five returned results."* [KM Manager] the view from a team lead is that it depends on the specificity of the initial definition. *"Primus is good for finding out if there actually are specific solutions for the problem...You'd have 50% alright you would like [find]a solution."* Experienced PSE. Another experienced PSE suggesting that subsequent, filtered searches increase the ability to locate a solution.

"Yeah it's my experience that you'll only hit maybe 30 maybe 40% of the time. To me 20% to 30% of the time you'll hit the first time I mean in general and I'm very generous there 30%. Another 40% of the time it's actually in there and actually a good one in there. Finding it... I'd go higher than 40%-50% and I'm being minimalist there, but a lot of the time it's the finding of it, the finding of the information that's in there somewhere."

Experienced PSE

The source of the case, whether it originates from an automatic dial-home or from a customer call, affects how the subsequent search is carried out. Dial-homes provide information detailing specific time-stamped error codes. These can be automatically transferred from Clarify into Primus as search terms. The only technical issue occurs when this process truncates lengthy lists of error codes and during transfer.

Where there is a Customer Support Technician (CST) at the customer's site they may have already defined a problem from talking to the clients' technical staff and inspecting equipment and log files: this may be augmented by the CST themselves searching Primus.

Though searching is efficient in straightforward cases, when the problem is more ambiguous PSE's report needing to modify the automatically selected text or alternatively choosing their own search terms.

"but then they have the problem and if they can't see a drive so it would be like looking for a needle in a haystack. you would have to kind of take out some words you have in the details, like from what the customer describes to put that into Primus you know you're looking for a needle in a haystack."

Mentor

While accepting the value of a knowledge management repository, there are problems with the knowledge management system's search capabilities. PSEs when searching, can run an automated search that takes error code and configuration details to populate a Primus search. The PSE may modify the default search terms before searching Primus where it is felt this would improve results.

A traditional view on knowledge management may see the search activity as a way of identifying the minimum amount of codified knowledge that must be transferred to accomplish as task. This research found that PSEs engaged in a number of discernable types of search that are discussed next. After this the context specificity of retrieved solutions is examined and the process by which PSEs scope solutions.

6.2.1 SEARCH TYPES

The information available to PSEs allows them to engage in one of five types of search activities.

1. Tacit Search.

The tacit knowledge available enables the agent to perform a series of contextually specific actions to resolve a case without having recourse to the knowledge management repository. Employees understand problems unambiguously from the available information. This understanding of relevant meanings exists as memory traces and acts to structure agents' actions, enabling them to accomplish knowledge work. It is supported by the repetition of cases that enable practices to be recurrently enacted.

2. Confirmatory Search

In this situation the PSE's understand the problem but, due to complexity of the knowledge domain do not feel confident to rely entirely on their tacit knowledge to take the requisite actions, see Figure 12 below. They search the knowledge management repository for a specific solution to augment their knowledge. Therefore limits on tacit knowledge and the complexity knowledge domains require the knowledge management resource to be drawn

upon. The recurrent use of this resource reinforces the PSE's understanding of a problem which, over time, enables the required series of actions to be immediately available to the PSE as a Tacit Search. This search type involves converting explicit to tacit knowledge because the sufficiency of existing tacit knowledge is questionable. Explicit knowledge assets enable consistency where complexity is high and supplements the inherent limitations of tacit knowledge.

Figure 12: Fix Procedure

Fix:

1. Verify that the device entry is indeed missing by running the following command: `ioscan -fnC disk`. A hardware path will contain `.255`, but there will be no device entry line following it. That is, an entry like `/dev/rdisk/c7t0d0 /dev/dsk/c7t0d0` will be missing. An entry like the following will be directly followed by another hardware path entry: `0/6/2/0.1.28.255.0.0.0 sdisk CLAIMED DEVICE DGC`
2. Run the following command to create the missing device files: `insf -eC disk`
3. Run the following command to show the hardware path and the new device entry: `ioscan -fnkC disk`
4. Stop and start the Navisphere Agent to push the host information down to the array: `/sbin/init.d/agent stop /sbin/init.d/agent start`
5. Run the following commands to show the new hardware path and device entry: `ioscan -fnC disk insf -eC disk ioscan -fnkC disk`
6. Now check the Navisphere Manager screen. The host should be registered with the array.

The meaning ascribed by workers to certain words determines their choice of terms. In new and developing knowledge domains these varied between individuals and groups. Even though Primus supported the 'concepts' capability a number of PSE's reported having been frustrated when they knew a solution existed in Primus while not being able to find the keywords necessary to find it during a search. In this situation they fell back on social interaction by asking for suggestions of alternative terms. Though repositories tried to codify idiosyncratic meanings this did not always work in practice.

By drawing on the knowledge management repository the PSE is able to reinforce and augment meanings around problems. PSEs can draw on the information contained in the repository to access meanings as part of enacting the search practice. The repository can, with recurrent use, facilitate the standardisation of meanings within a group through even virtual interaction. Thus it can aid the structure of signification existing within Level 1 product support.

Alternatively as PSE's read more solutions in a problem domain they become more familiar with the 'local terminology' – the particular terms used and their contextual meanings. PSEs' meanings are developed via social interaction and through day-to-day use of documents. Those who document solutions (examined in chapter 7) use these meanings in new solutions, making appropriate distinctions. These solutions, when read and interpreted by other PSEs exhibit a structuring property, reinforcing relevant meanings in a knowledge domain. The continual practice of documenting new solutions supports change and ensures that structures of signification evolve to support the changing environment in which they are used. The structure of signification developed support the exercise of agency as PSE's decide on the most appropriate terms to locate a solution.

3. Scoping Search:

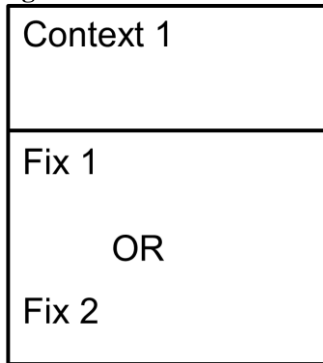
Here there is ambiguity around the case: solutions may present alternative courses of action. This is illustrated using an excerpt from a solution (Figure 13) and graphically Figure 14. Numerous known solutions fit the available information. Agency is exhibited in knowing what additional information will narrow the number of possible solutions.

Figure 13: Fix Alternatives from Solution

Fix:
Either: After the disk is made RW on the array, take the disk offline and bring it back online using the Failover Cluster Management snap-in.

or: Operating on the cluster node containing the online disk: Open a command prompt Run diskpart.exe In the diskpart prompt type select disk X (where X is the physical harddisk number from Disk Management) In the diskpart prompt type attr disk clear readonly Exit diskpart and check again

If the issue persists, do the following:
Open a command prompt Run diskpart.exe In the diskpart prompt type list vol In the diskpart prompt type select vol X (where X is the volume number as per step 3) In the diskpart prompt type attr vol clear readonly Exit diskpart and check again

Figure 14: Fix Alternatives Diagram

The PSE may exhibit agency in developing a number of hypotheses about various effects and their causes. They may then seek to confirm or negate information in subsequent searches to narrow the number of possible explanations. In this situation the existing stock of knowledge is available to the PSE is insufficient to identify what a problem means in the particular context faced. Reflexivity allows them to search for solutions to narrow the scope of the problem.

4. Delineating Search:

Where there is a lacunae in the PSE's stock of knowledge about a problem they may run a delineating search. By reading themselves into the problem area the PSE builds their understanding by gaining access to new and more precise meanings. This either enables them to narrow the problem (Figure 15) so an existing solution can be found or identify what additional information is required to remove ambiguity. Though the objective of the knowledge repository was to transfer knowledge about a current problem for immediate application in practice it was also used by employees to learn more around a problem domain. This wasted time in the short-run but improved their capacity to act in the longer term.

Figure 15: Narrowing Down- Not Applicable

Environment: Product: PI-CORP Hardware CX4 Series
Environment: Product: PI-CORP Hardware CX3 Series
Environment: Product: PI-CORP Hardware CX Series
Environment: This statement does not apply:
Product: PI-CORP Hardware FC Series
Environment: PI-CORP SW: Navisphere
Environment: PI-CORP Firmware: FLARE Release 19 and later
Environment:
This statement does not apply: PI-CORP Firmware: FLARE pre-Release 19

5. Brainstorming Search

Similar to the previous situation instead of escalating the case as expected PSEs used an even more general search. However here the PSE's stock of knowledge is insufficiently developed to understand a problem domain. They search broadly for documentation about a problem with the objective of increasing their understanding (Figure 16). This activity may return a matching solution but more likely will prove the basis for running a delineating search.

Figure 16: Wider Understanding

Root Cause: The PI-CORP Hardware backend UltraPoint architecture prevents one failing drive from affecting other drives unless there was some other type of failure.

There are two advantages of allowing a disk to be put on probation multiple times: If this drive was an ATA drive that became inaccessible for short durations due to bad block remaps, the probational state gives the drive a chance to remap the bad areas instead of having the drive power down when bad sectors are first encountered...

However, it is possible that the drive may fail later for other (non-probational) reasons. A proactive spare can also be allocated for this problematic drive if appropriate. While copying data to the proactive spare, the drive may take errors. In this scenario probation is not considered. ...

Here learning occurs here through knowledge objects. Leveraging these assets avoided the use of tacit to tacit knowledge transfer.

“you have a Primus button linked to a solution, so what we put in then is the code level, you know the micro code the box is using, the error code and it does a search for all those and we have to put in more detail to maybe do a more refined search. It's fairly limited that way that's why I say it'd only give you maybe a head start. You'd probably find something like it but it's not, it's just another scenario kind of similar event but a little bit different, different enough that you can't follow the actions you take”.

Experienced PSE

Even when it is decided that the case is not directly applicable to the current problem the very act of reading it will further develop the PSE's, tacit knowledge.

“ it[Primus] definitely gives you a head start. It will point you in the right direction and a lot of the solutions are written up anyway and have links to documentation in the interface and even sometimes looking at Primus it will give you an idea and point you in a specific area anyway you know that maybe it's not in PI-CORP so maybe it's next door in the vendor thing so you sort of focus your attention on the external vendor as opposed to the PI-CORP problems and it might be able to help the customer that way.”

Team Leads

6.2.2 CONTEXT SPECIFICITY OF SOLUTION

The contexts in which solutions are applicable and inapplicable can be very specific.

“See a lot of the kinda solutions would be they'd be specific designs for a certain code type and you could be if you're above that code then only half a solution would apply. Well I mean a different code level, the new code now we have 6670.77.71 you know so like it's a different code so this could be tailored for 65, 68 and it mightn't be for 70 you know. Usually it will actually be quite different because I mean the box physically changes as well so a lot of the times it gives you a rough indication of what's actually wrong”.

Experienced PSE

Viewing knowledge as an object means that solutions should be codified so that the know-how of the fix procedure is matched to other know-when of the applicable context. If precisely defined and matched there is the possibility of employees using the repository in a fully programmed manner. The ability to follow the actions in a fix would be sufficient without needing to understand anything further.

This involves being able to cope with current products and services, so that PSE's using know-how could perform their work with a suitable taxonomy and searchable solution repository outlining current cause-effect relationships and fix procedures. In examining the sequence of errors (effects) the PSE uses know-why to determine the problem (cause). Where their know-why and cognitive tacit frameworks suggests a number of possible causes the PSE can try and narrow these down by considering the case context and how this interacts with the errors (know-when).

Change requires the development and adaptation of existing solutions as well as the creation of new ones. This means that ‘know-why’ is required to provide a theoretical understanding of the reasons underpinning why a fix works in a particular context. This is why know-why is causal (Alavi and Leidner, 2001) so that it enables know-how to be developed and applied in different contexts, (Sanchez, 1997) through ‘cognitive tacit processes’ (Alavi and Leidner, 2001). ‘Know-why’ is seen in the case company where employees look at the information available on changes, environment and errors to develop a hypothesis and identify a cause. A sufficiency of know-why enables the PSE to understand the link between the cause and the triggering effect. Another category ‘know-with’ (Alavi and Leidner, 2001) refers to an understanding of interdependencies and intercommunications which may be used for more difficult cases, particularly in software support.

Know-about, held in tacit form, is part of the PSE’s pre-existing cognitive framework, and where it is sufficient i.e. the PSE is au fait with the area, negates the need for further information gathering of facts (6.1 and 6.2). While the PSE’s tacit knowledge may be seen as an input it is their intellectual processes that transform these inputs into value adding fixes.

In practice PSEs include an extra element to those mandated by the repository: they include a rationale for the solution. The rationale provided the ‘know-why’ component. The inclusion of this informal section provided subsequent readers of a solution with an understanding of why the solution worked. It was hoped that this wider understanding on the problem would enable others to identify if it was applicable for a context not already defined.

PSE’s may also use their tacit knowledge to decide what information should be included in the solution in the form of a ‘rationale’. This is usually provided in the fix section of a solution but is added to provide contextual information on the fix procedure. It should be sufficient for the context to be understood by another. The development and use of the rationale makes the repository more flexible.

“I mean, I would’ve maybe thought that this error wasn’t too serious but in association with another error it might bring up a different solution. Altogether say the serious error and the not so serious error in my eyes, when primate sees those it brings up a different solution than it would’ve so in that way I think it’s all right.”

Experienced PSE

“It’s a combination no, on some of the Primus’s solutions alright there’d be one particular error code then if it logged a different one immediately after it then there’s a certain solution you’d use for where it’s logging on its own and it’s different.”

Novice PSE

Actors interpretive schemes exist only in the mind, and are constructed through recursive routines (Orlikowski and Gash, 1994). Recursiveness is present in the PSE’s work due to the repetition of problem types i.e. through a ‘sameness’ of contexts over time. This results in the perspective-making process of complexification. This process enables actors’ knowledge to develop subtle categories and distinctions strengthening their ability to enact the case analysis practice.

“The biggest asset we have is experience, like I’m there 10 years, there’s 3 of us in there at the moment and we’re there 8, 9 and 10 years...We get cases where, it’s experience again if someone has been in the lab for about 2 years and haven’t seen a problem before, then their first point is Primus, if you can’t see exactly what’s in front, what the problem is, if it’s not clear, then the experience limit comes into it as well.”

[SHIFT LEAD]

A PSE may engage in perspective-taking through the act of reading others solutions. They not only use their own interpretive scheme to focus on relevant detail for the current case but also gain a better understanding of the wider case context. This can modify their understanding of the particular causes and effects. Learning about the specificity of the problem contexts involves taking a specialist work teams perspective on a problem either through interaction or by reading solutions. This is subsumed into the PSE’s stock of existing interpretive scheme to be drawn upon in future circumstances. Figure 17 is an excerpt of a solution that emphasised different perspectives on a problem.

Figure 17: Perspectives in Solution

Fix: The PI-CORP Engineering recommendation when re-adding logical volumes (following an earlier online volume deletion) is to always reuse the original deleted device PI-CORP Hardware Product Volume Numbers (Symm Vol #).

What are the reasons for this recommendation?

From a PI-CORP Hardware Product storage and PI-CORP Hardware Product bin file perspective, always reuse the PI-CORP Hardware Product volume number associated with the NULL devices (highlighted in yellow on the SymmWin > Volumes Request screen).

...

From a Solutions Enabler perspective, you will always successfully re-use the original deleted device PI-CORP Hardware Product volume number...

Even in the case of hardware a physical artefact may be described in numerous ways by different groups. Primus tries to compensate for this in three ways. Firstly, it can use a feature that groups synonyms as a 'concept' so that all synonyms are used in a search where one of the group is entered. When communities develop idiosyncratic meanings this feature seeks to create shared meanings at the 'concept' level. Secondly, within solutions a 'global replace' feature can be used to replace particular terms with a standard term. Thirdly, as shown in Figure 18 the problem may be defined in a number of different ways, making searches easier.

Figure 18: Alternative Problem Definitions

Problem: The correct signature for the quorum is also shown in the cluster_registry.txt file:
HKEY_LOCAL_MACHINE\Cluster\Resources\e88a227b-8d0f-408d-ae19-fc20ac3675cc Name REG_SZ Disk Q: Type REG_SZ Physical Disk
HKEY_LOCAL_MACHINE\Cluster\Resources\e88a227b-8d0f-408d-ae19-fc20ac3675cc\Parameters Signature REG_DWORD 0x25fd21d7

Problem: Able to start cluster service with -fixquorum parameter, but when try to bring the quorum online in Cluster Administrator, the Quorum Group hangs with 'online pending' error.

Problem: System log shows following errors, but shows correct signature that is expected to be found on the Quorum drive:

6.2.3 SCOPING SOLUTIONS

Solutions span time by defining meanings needed to specify a problem context and fix procedure that can be accessed later by others though this is always subject to change. However, while solutions span time they are also rooted in the time in which they were written, and as such, cognisance must be given to changes, such as new hardware (see Figure 19) and software versions in the intervening period.

Figure 19: Changing Contexts

Root Cause: The availability of 250 GB and 320 GB Maxtor ATA drives will diminish over time and it has become necessary to introduce alternate replacement drives. The new replacements are Seagate Galaxy drives, which require new FRUMON code 1.93 or a later revision in order to be recognized.

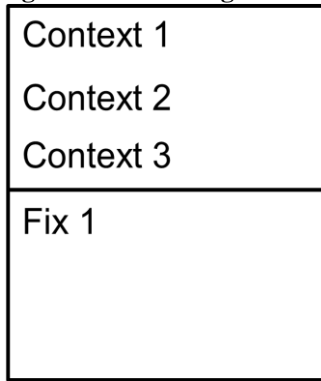
This involves agency as the PSE draws on their interpretive schemes to define and redefine contexts' boundaries to develop more subtle distinctions.

In a new knowledge/problem domain solutions may initially be defined too broadly. While a solution may solve a current problem subsequent cases may indicate conditions, not present in the initial problem, but relevant to the applicability of the solution. This requires the PSE to redefine boundaries.

A single solution may work in a number of contexts e.g. a solution works even the client is running two different operating systems (see Figure 20 and Figure 21 below).. Once PSE's have satisfied themselves this is the case the second context definition will be added to the 'environment' (or 'fact') section of the solution.

Figure 20: Multiple Environments

Environment: Product: PI-CORP Hardware CX3-series
 Environment: Product: PI-CORP Hardware CX-series
 Environment: Product: PI-CORP Hardware FC-series
 Environment: Product: PI-CORP Hardware AX-series
 Environment: Product: PI-CORP Hardware DL-series

Figure 21: Widening Solution Contexts

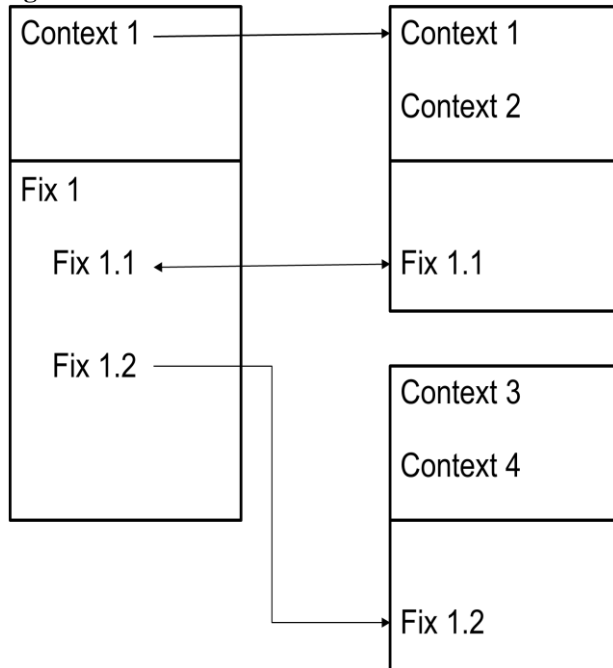
This is a situation where the meanings contained in a solution are applicable can be broadened over time as more problem instances present themselves.

Sometimes the fix procedure in a solution can be lengthy. In Pi-Corp fixes could be segmented, similar to the use of sub-routines in a software program. As can be seen in Figure 22 a fix procedure may refer to other fixes that perform a self contained outcome.

Figure 22 References to Solutions

<p>Fix:</p> <p>PI-CORP NetWorker Disable CDI This will stop Test Unit Ready (TUR) messages from causing tape rewinds during backup operations, which leads to error messages during future read attempts to that tape.</p> <p>Pi-Corp131369 ("Tape headers/ labels are being overwritten")</p> <p>Pi-Corp133043 ("Disabling NetWorker Common Device Interface [CDI]")</p> <p>...</p> <p>Windows Hosts</p> <p>Disable TURs by editing the Windows hosts registry.</p> <p>Pi-Corp131957 ("Disabling Test Unit Ready (TUR) requests on a Windows 2003 server")</p> <p>Disable the Removable Storage Management (RSM) service. This service can interfere with backup applications control of tape libraries and tape drives.</p> <p>Pi-Corp133043 ("Disabling NetWorker Common Device Interface [CDI]")</p> <p>Pi-Corp124775 ("Dynamic drive sharing on PI-CORP Disk Library [EDL] can cause tape volume corruption")</p>

Figure 23: Solution references other Solutions



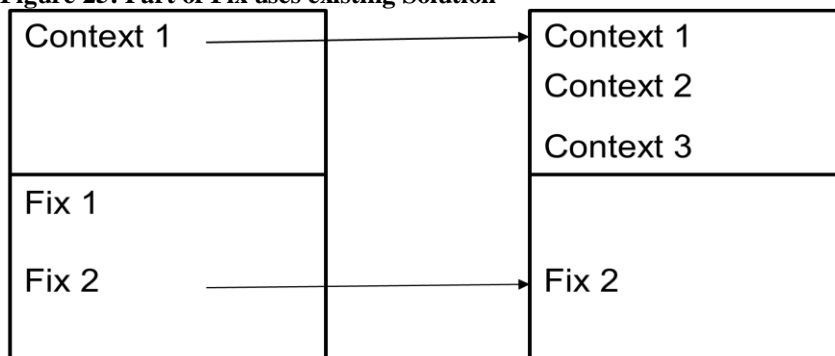
The figures above are a special type of solution. In this case a subset solution refers back to only the referring solution: a one-to-one relationship.

Figure 24: Solution Internally Referenced

Root Cause: This solution is a subset of solution Pi-Corp203203 for the fix
 Example procedure #1: If the PI-CORP Hardware Product disk to be replaced has locally unprotected devices with configured SRDF protection. The purpose of this version of the solution is to provide only the salient information required to run the procedure.

The details and full explanation for this solution are covered in solution Pi-Corp203203. If in doubt, please refer to that solution for full information.

Figure 25: Part of Fix uses existing Solution



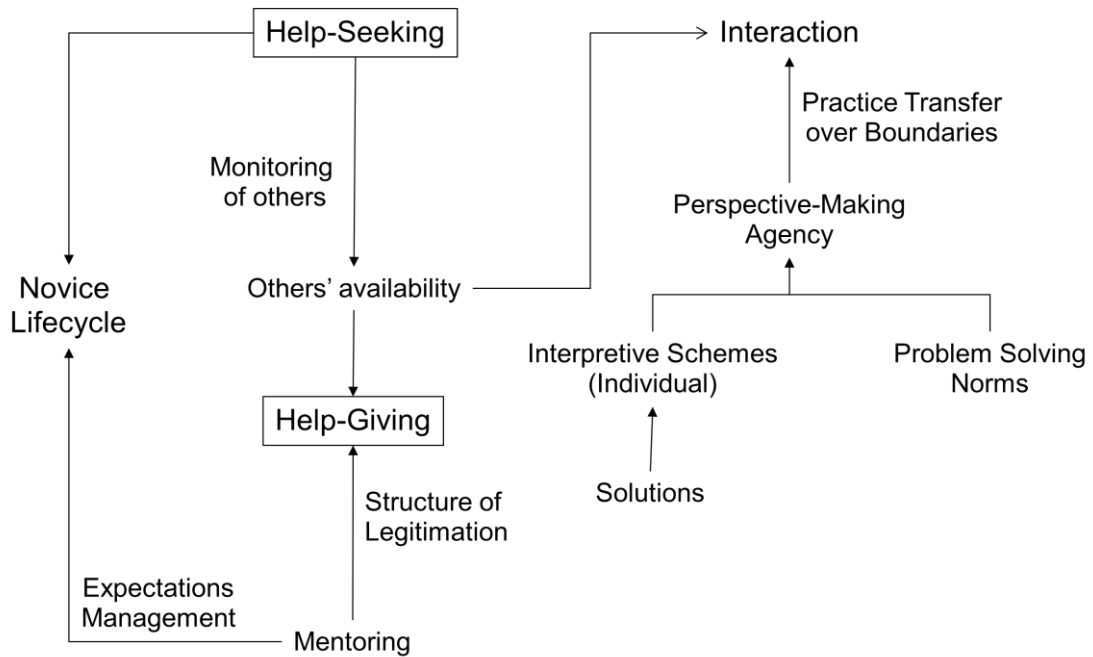
6.3 HELP SEEKING-HELP GIVING

As well as being divided into teams based on knowledge domains the organization also places novice PSE's into mentor groups. Novices are allocated a mentor who is very experienced as a primary point of contact while also having a second experienced PSE as a back-up available to offer help to typically two novice PSE's. Because of this extra activity mentors have less structured daily activity with more interruptions to their own work. Being assigned a mentor within a particular knowledge domain builds depth of knowledge in that domain for novices, as well as providing support as they develop their more general ability to close standard cases across domains. Novices are rotated through a number of mentors in their first year.

From a traditional knowledge management viewpoint mentoring is of value because novices may not adequately understand a problem and so may either (1) be incapable of accessing the relevant codified knowledge or (2) rely on an inappropriate solution. Mentoring allows tacit-to-tacit knowledge transfer until newer employees are sufficiently able to access and use the knowledge codified in the repository. For more experienced employees, adept at using the repository, if a solution was not forthcoming the problem should have been escalated to a higher level of product support. However in practice help-seeking and help-giving extended beyond novices and mentors to all Level 1 employees.

It is possible that novices, in some instances, can transfer work practices between different parts of the department because of their exposure to and rotations between different knowledge domain terms. Rotation means that the novice may be able to help their mentor because the former's interpretive scheme is more developed in a particular area. This illustrates how novices can span knowledge domain boundaries created within knowledge communities.

Figure 26: Help Seeking & Help Giving



The level of help required can vary from answering standard questions immediately by mentors which can take the form of a question asked and answered across a desk, or partition, to more subtle and difficult cases requiring specialist knowledge and taking a day to solve side by side at a terminal.

Physical co-presence is an important. One manager spoke of the need to redesign part of the 'cube farm' office space continually to accommodate new employees so that they were placed near the physical centre of teams, surrounded by their mentor group and more experienced team members with whom they could interact. This proximity also enables all members of the knowledge domain to discuss cases across low partitions, allowing novices to pick up meanings and work norms indirectly and unintentionally.

Where a novice is not learning at a satisfactory pace the department manager and mentor may agree that additional help is required. This is often done without the novice or their immediate group being aware of this decision. Here a decision is made to give help without a request from the person in need of help.

Coaching is used to disseminate legitimate shared meanings around a technology (Orlikowski et al., 1995a). The primary socialisation mechanism for novice PSEs into more advanced problem solving practices is through mentoring. Where communal knowledge is spread asymmetrically within a group it can be shared among members through know-how and tacit knowledge (Seely-Brown and Duguid, 2001). When stuck on a difficult problem a novice PSE will initially check with other novices in their mentor group, then going to their mentor, who, depending on the severity of a problem may call on an informal specialist. Not only does the novice get support in the practice of problem solving but also learns the practice of help-seeking. They learn the specialists who are knowledgeable in certain areas as well as how to initiate and engage in interaction with such specialists. There are social norms that are acquired in the interaction that legitimate the ways in which contact is initiated and conducted. The help given by specialist PSE's and mentors are an example of social affordances (Cook and Brown, 1998) that scaffold knowledge (Seely-Brown and Duguid, 2001).

Community members, either through direct interaction with apprentices or via solutions highlight relevant signifiers and the meaning to be taken from them in various contexts. This allows the development of strong ties (in a mentor group) and weak ties (specialists). Specialist content knowledge is developed in individual knowledge domain teams. Help seeking involves choosing an appropriate boundary spanner.

Another feature to be considered, outlined by the software manager, was the need to use help-giving as an opportunity to socialize and build employees competencies in the practice of documenting solutions. This requires knowledge of how employees are progressing and providing concrete opportunities for them to develop in this practice. The mentoring concept is used here, with employees who were not used to writing solutions being allocated a co-author typically the person who worked on the case with them or their mentor. The traditional perspective sees this work as straightforward. From a practice-based view this illustrates how a wider community can offer 'social affordances'. Even with explicit formal guidelines social support is also needed and available to novices. This illustrates the importance of more subtle monitoring of employees by those at slightly higher levels in the organization and knowledge community.

6.3.1 NOVICE HELP-SEEKING

In seeking help novices go through a life cycle. They will have been initially recruited for their technical skills and given a number of weeks formal classroom training on the firm's product lines. This level of knowledge enables them to solve basic cases. In practice what may seem like an easy case may 'explode' and, on examination, turn out to be more complex. In this early phase novices can feel it is a sign of weakness to ask for help and so the mentor group structure allows them to ask questions of a mentor with whom they have had an opportunity to build a relationship.

"Yeah, they find it very difficult because you have your people in the group that are just so experienced that they seem to know everything and then the new people do kind of feel, not intimidated but they're a little bit shy in bothering people too much."

Software Manager

The dangers of a novice not identifying a serious problem because they did not seek help make the effort required for mentoring worthwhile. There is an organisational norm that, where practical, the PSE who takes the case, even if they are a novice stays with it as long as practicable. Rather than taking over a case the mentor works on analysing the case with the novice to arrive at a solution. This allows novices to gain technical knowledge and understand the stages of the case analysis process. It also gets them comfortable with asking for help. In more complex cases the novice even witnesses their mentor seek help from specialists, reinforcing the legitimacy of help seeking.

The objective of this process is to have PSE's reach a stage where they are comfortable enough with the cases that they become self-reliant. This involves balancing taking on more difficult work without overextending themselves and not requesting help. The risk of overextension is limited by temporal work norms i.e. they only have a designated time period to solve the problem.

"There are some people who do get into the habit that they don't think for themselves, you just have to remind them to think for themselves every so often that you've already told them, you've already pointed them in the direction...it's basically all about confidence you know."

Mentor

At a certain point, when novices' tacit frameworks have become more developed they are pushed to take more difficult cases by managers and mentors. It is in the mentors interests to do this as it reduces the volume of cases that they and other experienced staff must take. This development is facilitated by the case management system's classification of case severity. After a period of time (typically 6-9 months) novices become able to handle the standard cases that they are faced with and enter a 'comfort zone'. There is a danger that they will remain at this level where they meet productivity targets by taking the less difficult available cases.

There is a danger that the novice draws on this help-seeking practice to the extent that they become over reliant on others, continually delegating agency to others. Through day-to-day interactions with their mentor novices will be able to 'fine tune' their understanding of norms relating to the help-seeking practice. Inertia may occur when novice PSE's are able to participate in the case analysis practice so that they can solve sufficient standard cases to meet their productivity metric. This threat of inertia can be overcome by managers and mentors engaging in an act of 'metastructuring' whereby they outline new norms and expectations regarding the level of case difficulty a novice should be capable of closing. They also introduce the expectation that the novice PSE should also be documenting solutions.

The social interactions between manager, team leads and mentors means that there is reflexivity on each novices' capabilities independent of any formal annual review. This is possible because there is informal monitoring by those with supervisory responsibilities that provides a knowledgability of others behaviours.

Getting new employees 'up and running' (Louis, 1980) is supported in Pi-Corp not only by mentoring but also by the automatic system feature which problems are categorised in terms of severity. (Louis, 1980) argues newcomers may not know which unfamiliar cues require a response. The development of interpretative structures as newcomers are socialised occurs as a part of daily work practices because the development of meanings are supported by social interactions around work and also by the knowledge management repository. For PSE's an important act of agency is identifying problems that are out of the ordinary and cannot be dealt with in a programmed manner. This may be considered a

form of 'triage': they need to be open to surprises coming from apparently ordinary cases. Due to the structured format of the solution genre may initially appear similar.

Formal feedback on performance, available from the system, enabled PSE's to pace their work activities. Feedback was also provided informally by mentors and team leads as well as managers. The need for others to convey their expectations as part of the socialization process (Louis, 1980) occurred through continuous monitoring and provision of formal and informal mentoring and monitoring. Because information seeking was primarily system mediated when social interaction was required with clients there was less opportunity for social integration. Relationship and network building through help-giving and help-seeking were more valuable for social integration.

Some of the newer PSE's, while believing they did not possess sufficient abilities at present were not as daunted as those who had perennially refused to add solutions. Newer employees saw it as simply another process requiring information to be input into another system. This illustrates how opposing interpretive schemes exist among groups in the same department.

6.3.2 INTERACTION

For difficult cases even a mentor may have to request help from a specialist. Typically the novice will still be involved in the diagnostic process. This provides them not only with knowledge of other's specialist strengths but also with the opportunity to work with specialists. This develops their understanding how more difficult cases are analysed.

Specialists disseminate their knowledge differently. Some will be prepared to provide varying levels of background and context to a case while others will focus on a quick resolution of the problem over knowledge transfer. This interaction initially provides novices with the opportunity of seeing specialists work in a safe environment, as their mentor and specialist drive the problem analysis interaction with the novice taking a more peripheral learning role.

“so a lot of the time I’m explaining the situation, what I’ve looked for, what I’ve found to somebody more senior and that helps them out and then that helps me out going over it and confirming I’ve done the right thing, did I make a mistake error and if I didn’t look for something they’ll ask why didn’t you look for this? So, it’s actually a lot of help for when you get a bad case and you have to call somebody in you learn a lot from that because they’re asking you questions to get a better understanding of it.”

PSE

There was widespread acceptance among mentors and experienced PSE’s of the need to provide help to novices.

Collaboration is not necessarily reciprocal- help seeker will look beyond personality and want technical ability because they have tough deadlines to meet. Some people will be avoided. Help seeker will get a 'nose' for this (who to ask for help) after being "burnt" once or twice. You will go around the room, but selectively.

Experienced PSE (interview notes)

Some employees see help-giving as an obligation. They feel a need to repay the debt created by them when they started work and needed help. This could be considered an example of ‘indirect indebtedness’ to the department as there is no direct reciprocity to the original help-giver. In this situation help is received by one group at a point in time who later pass on help to a new group. Here the indebtedness stretches over time: a minimum of 6-9 months can elapse before a PSE is able to begin to repay their indebtedness. This exists in the form of memory traces, and is passed on ‘inter-generationally’ over time.

“I never had a problem with people helping me. I don’t I think in this place anyway when you come in you need so much help and you ask so much help, that you feel you owe it and it just kinda goes along like that. I’d ask like a million questions and I’d find people are asking me like a million questions now but like you’ve felt you’ve done it all and they have to ask you and that’s just the way things are.”

Experienced PSE

The choice of help-giver is primarily dependent on the degree of knowledge diffusion in the group. Where the relevant knowledge is narrowly diffused there may be little or no choice about whom to approach. With wider diffusion the help-seeker has the option of choosing a specialist with whom to work based on previous interactions as well as case requirements. The help-seeker must also judge the availability of the other to help.

Help-giving is built into mentor's job description but this is not the case for specialists. The term 'specialist' is an informal term not conveying on the holder any workload reduction to help others. Therefore specialists must balance their current workload with any help they choose to offer. Help-giving by specialists is supported by the system feature 'touches'. Though a case can only be opened by one person at a time there is a capability whereby credit can be given to others who have helped in its resolution: those who have 'touched a case' which is equivalent for workers productivity metric to a half a closed case. Agency is required in choosing which team member to approach with a problem.

When help is requested there is a work norm that the help-seeker has the 'spade-work done' before interaction. The seeker should have collected all relevant information on the case and have searched the repository. Given time constraints particularly on the help-giver this level of preparedness is seen as important. Help may be given in the narrow sense of diagnosing the current problem. This is facilitated by the norm or 'staying with the case'. It also occurs in a wider sense of engaging in a social interaction that enables learning to take place. This means that even when mentors and specialists become involved in a case the novice is still involved, however peripherally.

In offering help it is a norm for the seeker to outline the problem and their attempts at developing a fix before the helper engages them in a question and answer session. This communicative genre is also used in other diagnostic settings e.g. hospitals. This saves the help-giver time reading through documents. It also helps develop the help-seeker's understanding of the problem analysis practice because the process of searching, reading then talking through the problem forces them to consider the meanings they have on a problem. These meanings will then be refined by the help-giver asking questions as they analyse the problem. This interaction also allows the help-seeker to see what is deemed relevant by the specialist when resolving the case and provides the setting to ask questions for clarification when they are unsure of the help-givers thought process. This social interaction allows the help-seeker clarify their stock of knowledge and norms regarding how to appropriately analyse a case i.e. they better understand how to enact the practice. It also allows the help-giver monitor the other's activity.

Experienced specialists can help by giving their sense of the situation using question and answers if they know the solution, or engage in group perspective-taking through what (Louis, 1980) calls ‘reality testing’. This is also similar to (Kirkman and Rosen, 1999) quoted in (Morgeson, 2005) where team leaders coaching improved learning by providing psychological safety.

The interpretive schemes drawn on by employees develop over time with experience. (Dickey et al., 2007) argue that only one party needs to be able to engage in perspective-taking for communication to occur. Due to the asymmetric distribution of knowledge in Pi-Corp it tends to be (1) the PSE who takes the clients perspective on their environment, changes, and problem or (2) the novice taking the more experienced PSE’s perspective. Perspective-making when developing a solution occurs within the case company. Once a perspective is made PSE’s help clients to engage in perspective-taking during interactions so that they can see the result of the process. The PSE’s in PI-CORP are more knowledgeable and, unlike (Dickey et al., 2007) able to engage in interactive questioning of each other and clients, not being limited to predefined and codified texts. Unlike (Dickey et al., 2007) PSE’S do not view solutions as their “universe of knowledge” but can add to and modify these texts as they make and remake their perspectives on a problem.

6.3.3 THIRD PARTY INTERACTION

(Roberts, 2006) refers to ‘alignment’; used to ensure local activities are sufficiently aligned with other processes to make them effective beyond the local engagement. In complex cases annotations are used to achieve alignment across time zones and with higher levels. Solutions enable alignment with customers for standard cases. Departments providing higher levels of support seek alignment with Level 1 product support formally using technical advisories. PSE’s can aid alignment by accessing higher levels’ work in TECH2 progress documents.

PSE’s also use external documentation to maintain alignment with third parties. As (Dickey et al., 2007) argue, where customer sales representatives-client interactions are short-term it is more difficult to coordinate perspectives as longer time periods are needed to develop complexified perspectives. Like (Dickey et al., 2007) either side may not be

able to take the others perspective: clients may not be as technically aware of the case companies systems while PSE's may not understand how clients configurations interact with PI-CORP products. Interviews found that rather than engage with clients in complexification, PSE's tried to take clients' perspectives when engaged in perspective-making, then when the problem was resolved, explained what had happened to clients.

Customer contact could be at arm's length when the information to be exchanged was explicit knowledge. There was therefore little opportunity to build up significant social capital with customers. This did however make it easier to share knowledge in the form of solutions. Whereas WebGA (Schultz and Orlikowski, 2004) also provided structured information for 'Self-Serve' it made this freely available, unlike PI-CORP where PSE's limited what was made available externally. This was because by taking clients' perspectives PSE's were able to exercise agency and decide if a solution would be open to misinterpretation. (Dickey et al., 2007) found customers failed to understand technical references that were taken for granted by customer sales representatives. During interactions in Pi-Corp this is not absolutely necessary as PSE's were able to remotely access the customers systems or call on an on-site case company engineer to take appropriate to take appropriate actions without a need for clients to be knowledgeable in the area.

(Schultz and Orlikowski, 2004) found Self-Serve technology changed work patterns in four ways: it increased information overload on agents; it displaced consulting by salesmen; it reduced the frequency of interactions and it required social capital to be expanded to promote the technology to which customers had access. In PI-CORP case findings were different. The Self-Serve technology reduced information overload by allowing clients resolve standard problems reducing the number of such cases handled by PSEs. By increasing the proportion of complex work it increased the level of knowledgeability required to accomplish the remaining work. Because PSE's limited the information available on the Self-Serve technology, clients had to seek the help of difficult cases. The ability to find and solve simple cases for themselves increased clients' knowledgeability while allowing them to appreciate the more complex work undertaken by the PSE's.

The frequency of customer interactions were not affected as this was determined by the number of high severity cases that occurred. There was no social capital expended to encourage clients to use the Self-Serve technology. There was significant uptake of the self-serve website because it enabled clients to resolve standard problems quickly without recourse to the customer support department. The value to clients was therefore sufficient to encourage system use.

(Roberts, 2006) refers to earlier work (Roberts, 2000) arguing that trust, mutual understanding and familiarity are built in social and cultural contexts. In the case company these are developed initially in socialization and are maintained due to the difficulty of the knowledge work in requiring help-seeking and help-giving. While employees trust others will help when available they must exercise agency in choosing whom seek help from, drawing on their familiarity of others' problem solving styles.

Though PSEs were distributed over time zones and shifts they still had a critical mass of physically present co-workers. Previous external social networks were less valuable due to the context of specificity of the knowledge work, unlike the findings of (Cho et al., G. Gay). The structure of mentoring facilitates a close network to develop, enlarging over time through mentor rotation. However cases requiring special knowledge force the employee to move outside their networks using reputations to find support.

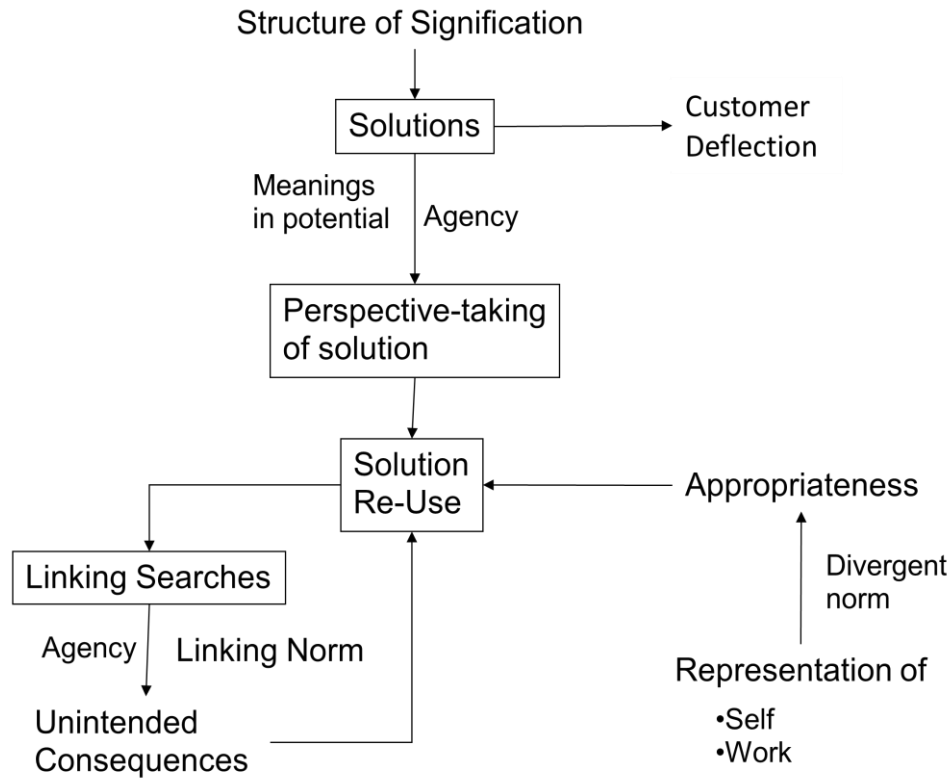
6.4 SOLUTION REUSE

Traditionally this stage was the reward for the effort that went into organising and codifying knowledge. The objective was to improve efficiency by leveraging knowledge assets through re-use. In the case analysis company re-use should decrease the time taken to resolve a case as well as allowing it to be solved at the lowest produce support level. Novel cases that might require time for analysis were to be escalated to Level 2.

While knowledge is contributed by members of a community for the benefit of all (McLureWasco and Faraj, 2000) this knowledge may not be freely shared in organisations that treat it as a commodity, which gives the firm a superior bargaining position (Seely-Brown and Duguid, 1991). The use of the knowledge repository had the potential to

deskill Level 1 PSEs. Though it reduced the value of their tacit knowledge complete deskilling did not occur because the firm could not be sure the underlying re-use context had not changed, requiring existing solutions to be modified.

Figure 27: Solution Reuse



Because of organizationally sanctioned norms regarding time limits and productivity metrics PSE's accepted the resultant norm that they must reuse parts of others work rather than preemptorily try to develop their own solution. Re-use is made possible because, for a solution to exist a perspective has been developed in the knowledge domain enabling the externalisation of stocks of knowledge. This perspective is not individual as solutions may be developed and subsequently amended by a number of people and so represent a group's structure of signification. There is also a shared meaning among some PSEs that re-using others' solutions distributes any potential blame that may occur from using a solution inappropriately and so acts as a protective mechanism.

6.4.1 DEFLECTION

The organisation, by giving customers access to its solutions via a customer support website seeks to leverage its knowledge re-use beyond the firm boundary. Producing better solutions acts to deflect cases so that, as PSE's reproduce this practice, they also act to recreate structures of domination where power to close lower level cases is redistributed towards customers. Over time this changes the nature of the PSE's own work on which practices are based.

In terms of the dialectic of control PSEs had little power to stop this change. Documented solutions were central to their work and there was no technical barrier to making them widely available to customers. It was possible for those creating solutions to ignore readability norms and make new solutions understandable only to other PSEs. However, those writing solutions were also responsible for closing above average numbers of cases and did not define their work in this way (discussed in 6.3 and later in 6.7.3). Solution authors assumed that only PSEs would be capable of dealing with more complex cases and given the increasing volume of work saw this change positively because it removed some of the more routine aspects of their work. This change suited their representation of their job and the meanings they held about the work they did as being focused on problem solving novel cases and documenting such solutions.

“there's a lot of the time, especially with operating system type errors that, maybe similar to what I'm seeing but the fix isn't, the fix that I need so you can identify if the symptom is similar in [Knowledge Management Repository] solution then you can fix it great but still by looking at the fix you can figure out your own way.”
Experienced PSE

Rather than being worried about the solutions they documented reducing their value to the organisation instead they say this as giving them more time, because of deflection, to take on more difficult cases thus aiding their up-skilling.

6.4.2 LINKING SEARCHES

Before closing a case in the case management system PSE's should add the Primus ID of any solutions used to solve the problem. This linking cases to solutions enables the

company to use a knowledge life-cycle model. Linking cases to the relevant solution enables the organization to identify solutions (knowledge-objects) which can either be archived due to lack of use or where activity is increasing, prioritise areas for further action.

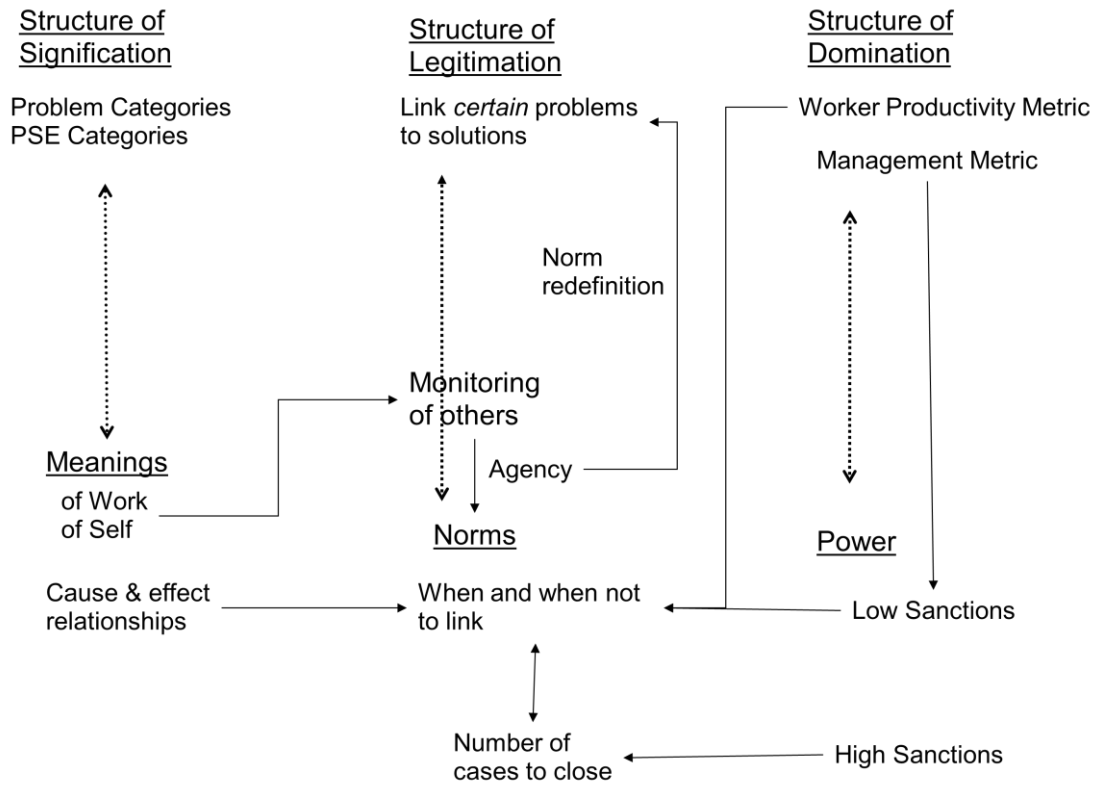
Having re-used a solution the next step that Pi-Corp expected a PSE to take was to go to the case management system and link the number of the solution(s) used to close the problem to the case file. This provided the firm with useful information on how often each knowledge-object (solution) was used. By cross-referencing solutions against the (already) identified error codes more automated troubleshooting procedures could be developed.

Structures existing at an organisational level have been found to centre on legitimate behaviour as in research by (Hayes and Walsham, 2001). Managers in the case company tried to develop two norms of behaviour around the practice of closing cases. First, through a norm that a certain number of cases should be closed. Second, by using a norm that PSEs should link each Clarify case to the relevant Primus solution before finally closing a case. However the sanctions used to enforce these norms differed. Compliance with the case closed norm involved heavy organisational sanctions, including, what were referred to in interviews as unpleasant visits to the manager's office. Regarding the second norm were a PSE not to link a solution to a case management system file was seen by PSE's not to incur sanctions. It would be easy for the organisation to ensure compliance, and enforce this norm, by requiring a solution number as a field before a case was counted towards a PSEs productivity. Because of the stronger sanctions around the case closed norm, the efficient use of time has developed a central significance among PSE's. Not linking solutions was rationalised as a time consuming 'administrative' task that took time away from what they perceived as the central work of solving and closing cases.

PSEs reflexively monitor the activity of others who engage in this non-linking norm. The circumstances in which this norm is not instantiated illustrates that PSE's are aware of the consequences of their own and others actions which in turn affects their behaviour. By defining this activity as 'administrative' they distance themselves from it. It is not seen as 'core work' like solving cases. They do not consider the wider implications for themselves and their work. In the long term the ability to improve the organisations lifecycle model

by reducing the number of obsolete cases would make searches more efficient and ultimately save their own time on the ‘core’ work of analysing and closing cases.

Figure 28: Linking Solutions



The shared meanings that develop in a problem domain constitute a structure of signification and result in the prioritisation of some norms over others. They mean that while focusing PSE’s on central aspects of work they can also create a narrow view of work. This was similar to the empirical findings of (Sandberg, 2000).

There were unintended consequences to this action. By not seeing ‘administrative’ tasks such as linking as relevant to their core activity PSE’s ultimately make their core job more difficult in the long run by recurrently enacting the ‘non-linking’ practice that recreate conditions where it was more difficult to remove obsolete cases. This ultimately increased the number of irrelevant search returns. This made the identification of areas requiring attention more difficult increasing the length of time PSE’s have to spend closing recurrent known cases. This situation buttresses (Giddens, 1979) argument that there can be a lack of rule and practice integration, where there is independence of action. This situation, similar

to (Walsham, 2002, Orlikowski, 1992), also illustrates how even in seemingly structured and formal knowledge management systems the technology may be adapted and used in varying ways

6.5 DEVELOPING A FIX

When no existing solution is applicable the PSE may attempt to develop a fix for a problem themselves. They are aided in this by the initial information already collected (section 6.1.1). They have ruled out existing solutions either because of explicit know-how such as a rationale, detailing (non)re-use contexts or through their own tacit knowledge whereby their understanding of cause and effect relationships ruled out solutions offered by searches. The process of reading existing solutions also provides them with additional explicit know-how for related problems.

These preceding processes improve PSE's tacit understanding of the problem. In addition, the firm provides explicit troubleshooting procedures which can be used to augment and structure workers' activities. PSEs may take actions designed to resolve the problem virtually or ask clients to perform certain actions and remotely observe the outcomes. If the problem is resolved they may be confident the actions have worked. Having previously read and discounted related solutions the PSE is then in a position to understand how their fix is distinguishable.

Even though no solution contains the precise meaning required the PSE may be able to develop meanings around a problem. This may be considered an example of 'renarrativising'(Boland and Tenkasi, 1995) whereby old meanings are changed in order to find new insights with the familiar being used to explain the unfamiliar.

An important aspect of the fix developed by a Level 1 PSE is whether a fix is temporary, providing time for a more thorough investigation, or a long-term fix that resolves the root cause of the problem (6.5.2). When a PSE has developed a fix procedure they must then decide if, in subsequent documentation a rationale needs to be included. This act of agency is considered in section 6.5.1. Finally (6.5.3) the actions taking to implement a fix are discussed.

6.5.1 WHEN TO PROVIDE CONTEXT

Writing a useful rationale involves trying to explain phenomena a PSE has only just come to terms with and involves narrating experiences, including advice on actions not to take, as well as details of how meanings have developed in a problem domain (see Figure 29). However to move this change in an individual's interpretive scheme to a structure that exists at a group level over time is achieved by writing and making solutions available.

Figure 29: Providing a Rationale

Fix: As long as the correct VERITAS ASL packages are installed, VERITAS VxVM should know how to handle this anomaly and function as normal. The key to failover mode 1 is that when an I/O request is sent to the passive path the PI-CORP Hardware array knows it does not have to trespass the LUN.

...

See also solution Pi-Corp127913 ("Requirements for running VERITAS DMP with or without PowerPath on a Solaris host attached to a PI-CORP Hardware array") and Pi-Corp110411 ("VERITAS Volume Manager 4.1 defaults to third party pseudo-names").

Annotations of work in progress involve more provisional meanings and provide others with a glimpse of the practice of solving cases. This can enable more reflexive PSE's to pick up techniques and ideas as a by-product having to deal with someone else's cases where they are transferred, e.g. over time zones. To improve rationales PSE's need to engage in perspective-making. This involves thinking not only what information will be useful to them as an 'aide memoir' but also what explanations of actions and analytical logic will be of value to subsequent readers. Some types of workers can analyse cases and solve problems, and while it is acknowledged that they do a fantastic job in this sphere, these same workers will not document their work. They tend to have a narrow view of their job consistent with previous research, (Sandberg, 2000, Vaast and Walsham, 2005). This will be discussed in more detail later in section 7.3.5.

6.5.2 TYPES OF FIX

Though a set of actions taken by the PSE may resolve the problem there are sometimes questions over the longevity of the fix. Some fixes were capable of getting the client 'up and running' albeit temporarily. This is because the fix did not resolve the underlying root

cause allowing the problem to reoccur. Such short term fixes are useful because by temporarily restoring the client's system access is opened to files that provide additional information that could be used in subsequent analysis.

Figure 30: 'Permanent' Fix Reference

Fix: Contact the PI-CORP Support Centre or your local PI-CORP service representative and quote this solution ID. A permanent fix is in progress and PI-CORP Engineering is investigating this issue.

Initially the case management system was configured to count all fixes as a closed case when monitoring employee productivity. Some PSE's chose to use this to their advantage. Instead of using temporary fixes to provide the time to conduct lengthier analyses they used them instead to close a case quickly, adding to their productivity metric. This was done in the knowledge that the clients problem would reoccur. The organization's reaction was to finesse the case closed metric. It instituted a 'first time fix metric' in the case management system. In order for a case to count towards a PSE's productivity target the same problem could not reoccur within a set period of time.

Some PSE's, to improve their case resolution metric use quick fixes that as the root cause was unresolved would reoccur. This illustrates knowledgeability as well as the reflexive monitoring of work and its organisational context. Similar to (Orlikowski, 1996) this practice emerges through ongoing improvisations in response to a contingent situation, and was seen as an opportunity by certain employees. Thus some managerial activities around knowledge management metrics do not stem from formal planning but are reactions to operational improvisations of workers as they enact practices. This is an example of what (Ghosh et al., 2004) termed a 'corrective' norm enacted as a response to unanticipated problems that emerged through adjustments and adaptations. Enforcement was achieved by building the 'first time fix' condition into the PSE monitoring software functionality. Thus the information systems were used to reinforce a structure of domination.

This conflict occurred because rules can develop multiple norms as argued by (Karsten, 1995). In this case different meanings and norms were developed around what constituted a fix. For some it is a series of actions enabling the case to be closed or, with the advent of first-time-fixes, enabling the customer to get or stay 'up' either completely resolving the problem or as a stop-gap to allow investigation of the root cause. Thus the fixes

developed by PSE's can be long-term or short-term depending on the knowledgability and motivation of the worker as well as the meanings they assign to their work and themselves.

6.5.3 IMPLEMENTING A FIX

The core of PSE's work is to get a client 'up'. A fix may be 'sufficient': the actions performed resolve the problem without an employee needing to fully understand the underlying root cause. In implementing a fix a PSE can draw on a number of resources. For known issues they can use patches and scripts written for a fully defined situation. In the case of hardware and networking problems the PSE may get a customer service engineer to physically carry out a particular procedure such as replacing pasts. They may also issue commands to a clients system remotely. Alternatively they may request the activities be taken by the client's technical staff (see Figure 8 on page 148 for an example from a solution).

Limited time constrains PSE's ability to develop their stock of knowledge beyond what is learned as a by-product of activities needed to find a sufficient fix. Thus a recurrent case may be closed even where there is limited understanding when supported by a well defined solution. Recurrence enables PSE's to remember required actions without necessarily knowing the rationale, unless this is readily available. Learning may thus be at a surface level with deeper learning dependent on having detail in addition to the set of actions present, as well as the PSE's own propensity to reflect on a problem to fill gaps in their stocks of knowledge.

Figure 31: Alternative Courses of Action

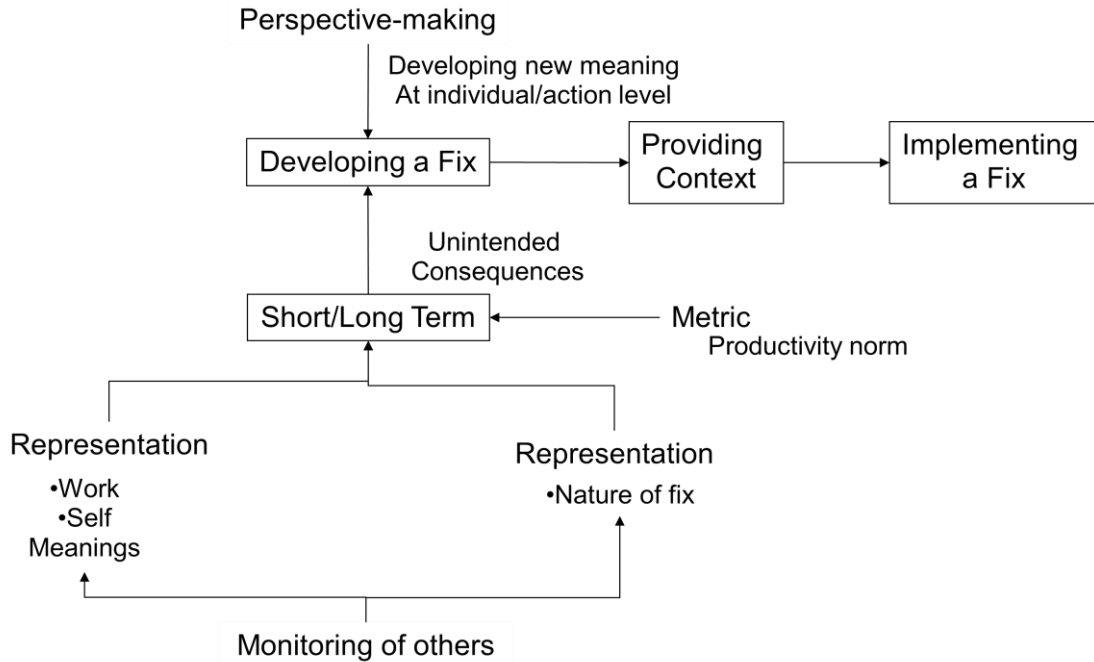
Fix: ... How to configure IBM's MPIO product using PI-CORP PI-CORP Hardware Product Storage is now also fully documented in the "PI-CORP Host Connectivity Guide for IBM AIX".

Generally, and depending on environment, customers should only do the following:

Install -> PI-CORP.PI-CORP Hardware Product.fcp.rte and PI-CORP.PI-CORP Hardware Product.aix.rte , if performing typical operations with an attached PI-CORP Hardware Product and either has PowerPath installed or not.

OR Install -> PI-CORP.PI-CORP Hardware Product.fcp.MPIO.rte and PI-CORP.PI-CORP Hardware Product.aix.rte ONLY, if desired to use the IBM native MPIO capabilities and PowerPath is NOT installed

Figure 32: Developing a Fix



6.6 ANNOTATING WORK IN PROGRESS

“A lot of the times what can happen is people are doing a fantastic job working the case but they haven’t documented why they think they’re going down this road fixing it and then this case has to be worked by someone else cause if they’re not in and in effect means you have to start from scratch over again.”

EXPERIENCED PSE

The annotation section of a problem in the case management system allows free text entry. This system stores annotations permanently. They provide a form of short-term organisational memory. They support efficiency in a number of ways. Storing details of actions taken on a case allows PSE’s in software to leave cases open in their work in progress folder for days. This facility is used while waiting for customers to provide information or take action at a suitable time.

Annotations also provide an efficient mechanism for escalating cases. By making all relevant information explicitly available they obviate the need for tacit-to-tacit exchanges among PSEs reducing ‘talk time’ or ‘hand-over’ discussions. This system feature enables any tacit-to-tacit activities to be replaced with externalisation of explicit knowledge by PSEs. By annotating their analysis the PSE ensures that if a new person works on the case they will see what has previously been tried and failed.

From a knowledge-as-object perspective annotations can be seen as ‘buffer objects’ that store explicit knowledge about the sequence of actions taken during the resolution of a case. Even though annotations are in an explicit format they contain the path to the solution: objective facts, actions taken, and in the case of unsuccessful attempts-unjustified beliefs with brief details of why these were ineffective. They may also contain as yet unjustified hypotheses as well as current interpretations of a problem.

Annotations may be written over an extended period of time and act to link periods of case analysis together. Not only can the decision to annotate occur in a continuous flow of actions (like a train journey) but the flow can be suspended and later reactivated (like a railway system with the continual use of sidings to park trains temporarily). They are written as a by-product of knowledge work and directly support the practice of analysing cases. They, like solutions, are only created through active agency, when the employee decides they are of benefit. Simple cases, when the fix is known are not annotated.

Writing up annotations differs from documenting solutions. Once text is entered as an annotation in the case management system it remains in that system. Further annotations about a case could be added but nothing could be deleted. These are stored in the case management system whilst solutions are stored in the knowledge management repository.

Annotations are written contemporaneously to keep track of relevant information. They hold the current thinking on a case, sometimes also containing details of attempted solutions that failed called negations. When the case has to be escalated any additional information that another may require can be added before the case is transferred. Thus annotations are typically written for oneself and only modified if needed by and passed on to others.

Cooperative work requires a shared structure of signification, (Karsten, 1995). Even though organisations may assume work is done by individuals each person relies, according to (Seely-Brown and Duguid, 2001), on a community of knowledge. From a practice-based perspective agency is exhibited as actors make sense of problems. In accomplishing this work they draw upon the meanings they possess regarding errors

exhibited in particular contexts. These meanings have structuring properties which are reinforced through the reliance on the organisational taxonomy and repository solutions.

Annotations can be read as the originating PSE's 'train of thought'. Not only does this provide immediate information on the actions they have taken but also acts as a learning opportunity allowing novices to see not only finished products, as is the case with solutions, but also see the work that went into them. Annotations thus show the *modus operandi* of how the case analysis progressed including the messiness of analysing cases. It illustrates a time when ideas and meanings were tentative and provisional rather than definite and polished. As argued by (Seely-Brown and Duguid, 1991) it is important to understand the *modus operandi*, how the process of completing a task is structured when options and unresolved dilemmas exist, as well as the *opus operatum* which sees the completed work. This is particularly important in knowledge work where predetermined outcomes cannot be guaranteed, (Davenport et al., 1996). Therefore annotations play an important part in the case analysis practice.

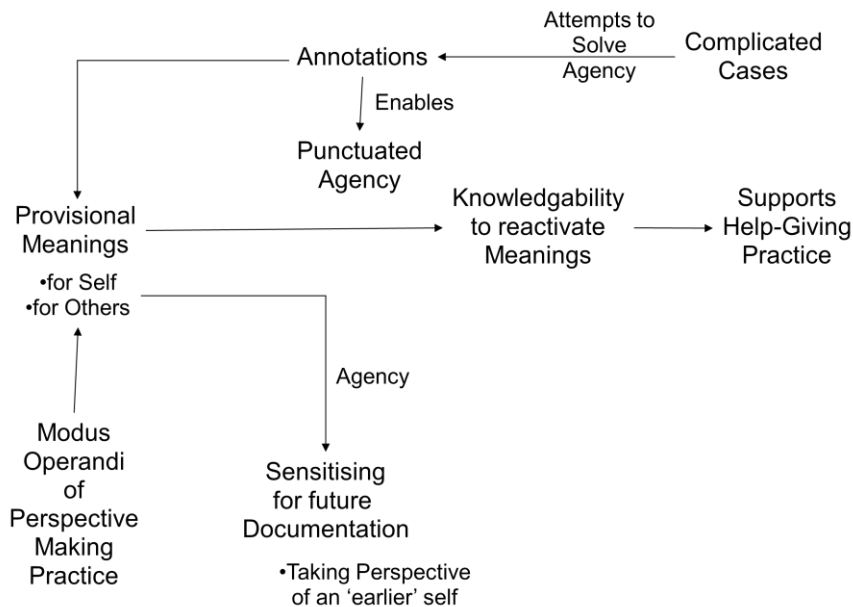
Perspective-making involves a narration of experiences. Annotated case notes involve a process central to Structuration Theory: the rationalisation of conduct and reflexive self-monitoring. They are built up where the case is initially ambiguous and serve a number of functions. They also contain the thoughts of the PSE regarding current meanings relating to a problem as well as possible hypotheses and solutions. They thus provide a record of how meanings are developed over time.

Annotations enable meanings to be stored not in memory traces, but in documents. These are capable of reactivation by those with a sufficiently developed interpretive schemes. They are necessary because agency can be enacted in a punctuated rather than continuous manner. By storing each attempt at problem diagnosis they enable the PSE not only to understand the solution but also their record of incorrect possibilities and difficulties with defining and redefining meanings met along the way in the search for a solution. Annotations allow them to be re-sensitized to the problem solving context.

PSEs exercise agency by drawing on meanings that are used to make sense of a problem. Annotations sensitise the PSE to contextual factors which may be useful in writing a rationale of they engage in the practice of documenting a solution i.e. identifying how and

why it is distinguishable from similar solutions. Annotations support the practice of help-giving as they allow experienced PSE to understand another’s thought process and the meanings they take from a problem.

Figure 33: Annotating



6.6.1 ISSUE COMMANDS

PSEs can sometimes fix clients’ problems by remotely issuing commands to a client system. Because some commands if issued incorrectly seriously impact a client a structure of domination exists whereby certain commands can only be issued by designated PSE’s. Less experienced team members have to request help from such members in this situation.

“Some occasion it can come up consult engineering or consult senior PSE or shift leader they’re the ones if you where you’re issuing dangerous commands like moving data or something like that. Basically you just follow Primus and you're on the right track.”

PSE

In this way those who are central to the knowledge domain can show less experienced members how serious commands are used in practice. This again, like (Seely-Brown and Duguid, 2001), emphasises the reliance, in even apparently individualised work, upon a community of knowledge.

As evidenced in Figure 34 though customer available solutions may include commands with serious repercussions they also include warnings on the dangers of misuse.

Figure 34: Issue Command Dangers

Fix:
...
A command to clear this situation is documented by Microsoft here: <http://technet.microsoft.com/en-us/library/cc773455.aspx> WARNING: before running the "cluster.exe node /clearpr:<disk number>" command, please note:
Use this command at your own risk
Mis-use of this command can and will lead to cluster/application downtime or data-loss
...
Use of this command will destroy logs and evidence needed for root cause analysis
PI-CORP does not take responsibility of the result or outcome of running this command without analysis done by PI-CORP support.

6.6.2 POST-FIX REFLECTION- NEED TO DOCUMENT

There was a formal requirement that if a PSE created a new, not already documented, fix then it was incumbent on the PSE to mark the problem in the case management system as one which required a solution to be written. As they had resolved the problem there was an expectation that the PSE would be capable of documenting the series of actions they had taken. There should be no reticence to document this fix nor should the writing of the solution prove problematic.

In deciding whether or not it is legitimate to document a fix as a solution the PSE draws on their understanding of the potential value of the solution to their knowledge domain. Some PSE's by defining their job as closing cases rather than documenting solutions did mark relevant fixes for documentation. They have chosen to ignore formal work norms and recreate the work norms of what turned out in this research to be the majority of their department.

Another category of worker would like to document solutions even if they did not possess sufficient understanding. This occurs even when they had the requisite knowledge to close the case. Here legitimacy is influenced by the individuals' perception of their own knowledgeability.

In the case of (Hayes, 2001) there was a reluctance to share when meanings were idiosyncratic for fear of misinterpretations by potential readers. In this instance PSEs also indicated a fear that they themselves may have misinterpreted the available information. While capable of taking the requisite actions to close a case they were worried that a ‘shading off’ of their bounded knowledgeability meant that their documentation of the solution would leave out context specific details. This may mean that another, using their case, would go astray and blame the solution they had authored. This worry existed in spite of procedures in place to check draft solutions before making them publicly available. Therefore they chose not to identify a case to be written up as a solution in the knowledge management repository.

6.7 MAIN THEMES

Having analysed the case analysis practice this section will outline the main themes identified.

6.7.1 SOLUTIONS GENRE

The substance of the solution genre relates to context specific problems and configurations which are categorized based on an overarching taxonomy. Solutions have a specific structural form and include lists of signifiers describing the problem environment (to ensure contexts are precisely defined) as well as problem definitions which can be chosen (to increase the consistency).

The physical form of the solution genre is constrained in the repository. However within this structure there is variability within the linguistic form even to the extent that it is possible to identify individual authors.

Solutions as genres are enacted as communicative practices within socio-historical contexts. They aid future responses to similar situations while also drawn upon within a ‘flow of action’ embedded in everyday work practices and so are particularly compatible with Structuration Theory.

PSE's were exposed to other communicative genres as they read third party solutions, relevant to customer problems which provided an external influence as well as company documents external to their department.

6.7.2 SOLUTION STRUCTURE

Similar to (Belanger and Watson-Manheim, 2003) in Pi-Corp there is a 'substitution' mechanism where electronic media replaced face-to-face communication. Employees exercise agency by determining the bounds to which this substitution of media can be extended. This depends on each employee's understanding and their ability to interpret the problem and existing solutions. Some communicative variation occurs, where different media are used for similar types of communication. This is, as posited by (Belanger and Watson-Manheim, 2003) due to personal preferences. In the case company there was a preference to use e-mail over telephone communication as it provided a visible audit trail giving staff an extra sense of psychological security.

PSE's also engaged in 'polychronic communication' (Turner and Tinsley, 2002) when they used a break from interacting with one client to interact with others. This is both because they believed it was the best way of conducting work (given metrics and the importance of time) as well as also exhibiting a preference to engage in multiple tasks-particularly in those tasks that used automated scripts that were automated but require time to run. This agrees with the findings of (Bluedorn, 2002). This polychronic communication was not just because of the asynchronous qualities of e-mail as a communications medium but also in the case company because of temporal ordering of clients' work practices with which PSE's had to integrate their activities.

Face-to-face communication occurred typically with two, occasionally more, PSE's discussing a particular problem. Unlike (Woerner et al., 2004) e-mail was used to transfer detailed information from clients sites and was used not to document conversations so much as to replace them. Similar to (Woerner et al., 2004) e-mail was used to conduct, current conversations with PSE's getting updates on client readiness and information

requested. Unlike (Watson-Manheim and Belanger, 2007) where workers were members of multiple teams in the research site PSE's belonged to only one knowledge team.

Interestingly even when 'MyCo' (Watson-Manheim and Belanger, 2007) had specialized information within an information system (intranet) it could only be found with difficulty without knowing the relevant specialists name. This was different for this research because emphasis was placed on making solutions easy to search based fields within the document.

While (Watson-Manheim and Belanger, 2007) founded some knowledge sharing took place in formal meetings employees preferred this to occur in informal meetings: in Pi-Corp the preferred method was via the electronic repository because of its speed. Similar to (Watson-Manheim and Belanger, 2007) when this was not possible then face-to-face informal meetings, often involving two people focused on a single issue, were preferred. Formal meetings centred on allocation patient of documentation work. The 'situational' norms of e-mail as a record of interactions and as 'defensive documentation' found in both (Watson-Manheim and Belanger, 2007) case companies was also present in the case company.

Unlike (Yates and Orlikowski, 2002) draft solutions were passed to experienced PSE's for review rather than to an entire community. This was reinforced by the knowledge management system where power to sign off on a draft, converting it into either a final version or return it to the author for rework, was allocated to certain employees. Thus the system reinforced a structure of domination.

A variant of the review genre is where feedback was subsequently provided by a user who provides suggestions based on the solutions applicability to their current situation. This is an example of temporal distancing. Another variant was where a review of the solution is bypassed and modifications were made directly to the document. Similar to the findings of (Yates and Orlikowski, 2002) accountability of actors for the documents impact the enactment of this variant.

6.7.3 DEFINING WORK & NEGOTIATING IDENTITY

While managers could exhibit agency by undermining procedures in order to progress projects where they felt the situation demanded (Coopley et al., 1997) research in Pi-Corp found examples where knowledge workers also exhibited this behaviour an example will be examined in section 7.1. (Hales, 2007) found that first line managers used improvisation when faced with divergent expectations which they had to translate into specific actions. In PI-CORP first line managers faced divergent expectations around quantity metrics balanced with the need to develop deep case analysis practices. Not only was identity creation necessary for frontline managers as (Hales, 2007) but in PI-CORP this was also relevant to the knowledge workers themselves.

The research site was similar to the compound case (Hayes and Walsham, 2001) in that there were classes of employee identified in Pi-Corp (this will be discussed in section 7.3.5): one focussed on metrics while the other was interested in developing a skill set that allowed them to accomplish core work better. The actions of these two groups diverged. In PI-CORP the group concerned with metrics were not, like those in (Hayes and Walsham, 2001), ambitious for advancement. In PI-CORP those who developed a reliance on metrics did so not from ambition but as a survival mechanism. Those who concentrated on taking more difficult cases, adversely affecting their metric, did so to develop broader problem solving skills that made them more suitable for promotion. While productivity was apparent to department managers this was sufficient to keep one's job: however problem-solving and diagnostic skills were necessary for promotion. Because of middle management's opacity to the day-to-day detail of the work they needed to rely on operational managers to inform them who were technically competent for promotion. Unlike Hayes and Walsham's (2001) research where regional sales managers power was diminished by a new information system, this did not occur in the present research because promotion required technical competence. This could best be identified by operational managers through monitoring and mutual enactment of the case analysis practice.

Because all three geographically dispersed product support centres potentially dealt with every client there was no value to regional or national discussion boards. Every case and solution was relevant to the entire product support division. Promotions tended to be within the department, or to a higher level of product support. The flatter organization structure is

similar to the new organizational forms considered by (Mintzberg, 1988) where promotion is not to management but to more challenging positions within the same work domain.

6.7.4 KNOWLEDGE WORK

- The work faced by employees in the case study was highly complex and at times ambiguous.
- A large proportion of ‘standard’ work was achieved by drawing on only the knowledge workers interpretative schemes and problem-solving skills.
- The body of knowledge used by workers can be defined as ‘justified true belief’ when it successfully solved a client problem with no adverse repercussions.
- Change, in the form of clients using new company and third party products, modifies the context (degree of sameness) to be found in problems, requiring either new meanings to be created or existing structures of signification to be defined more precisely (complexification).
- The body of knowledge drawn upon by PSEs was constantly changing, albeit incrementally.
- As perspective-making and complexification practices make work more standardised it was possible to automate that work through scripts or remove it entirely using patches and upgrades.
- Knowledge workers have T-shaped skills. They had the ability to solve standard cases from a range of knowledge domains as well as specialist knowledge of a few domains.
- Communicative genres, with varying configurations, are drawn upon to accomplish knowledge work, augmenting the agents’ stocks of knowledge.

- Communicative genres, when recursively drawn upon, acted to build, complexify and change knowledge workers interpretative schemes.

6.7.5 AGENCY

- Agency is exhibited through all stages of the case analysis practice of transforming problem cases into fixes.
- Agency was used by PSEs to distinguish ‘events’ from ‘non-events’.
- The rote application of rules used in previous problems was not always possible due to underlying change. Thus PSEs were required to make continuous assessments of potentially changed contexts. This necessitates the application of agency regarding whether previous rules are sufficient or need modification.
- Agents generate hypotheses about cause and effect relationships present in the case problem.
- Agents drew on their interpretative schemes in order to define problems and the contexts in which they occur.
- Agents’ interpretative schemes are used in choosing appropriate search terms to use to identify if solutions exist in the knowledge management repository.
- The organisation is structured so that agents at different levels of product support could exert increasing levels of agency. There is differential access to documents reinforcing the distribution of knowledgeability and the structure of domination.
- Agency is constrained in certain circumstances where sections of solutions exist within corporate information systems but hidden from the agent.

- By filtering cases to appropriate knowledge domain teams agents make the boundaries around particular communities more pronounced.
- Some agents must balance their time between taking different degrees of case difficulty, offering specialist help, and mentoring.
- Agents also monitor others, judging others levels of knowledgeably; internally when seeking specialist help and externally when assessing the level and media used to interact with client support staff.
- An agent must know when it is appropriate to request help, and in the case of specialist problems, identify the most suitable available specialist.
- Agency is exercised when giving help. This required understanding another agent's level of knowledgeability and then knowing how to develop their perspective on a problem to cope with the emerging range of contexts.
- Some agents 'cherry-pick' easy cases to 'make temporal space' so they can take more difficult cases. This enables them to learn, while meeting organisational metrics.
- Agents chose to 'cherry pick' difficult cases in specific problem domains in order to develop a specialism and reputation in that area.
- Agents must make a judgement whether it is beneficial to document the solution to a fix as a solution.
- In novel, ambiguous or complex cases agents interpret meanings contained in various communicative genres, but particularly the solutions genre.
- In the most difficult cases social interaction is required where agents engage in a process of perspective-making to expand or refine meanings that can be combined and augmented from a number of different information sources.

- Agents may modify meanings within existing solutions, indicating relevant contextual boundaries for use and select relevant parts of previous solutions to be amalgamated into a new solution.
- Individuals and groups engage in perspective-making when defining the context of a problem. The circumstances in which a solution is applicable is based on meanings in force at the time.

6.7.6 MEANINGS

- Some meanings are defined at higher levels in the firm and codified in documents, in the environment tree or defined in terms of identifiable conditions as error codes.
- Meanings exist along a spectrum from highly structured (environment tree) to at best provisional (annotations of work in progress) depending on the purpose of the communicative genre used.
- Even within communicative genres such as solutions meanings can be both structured (facts, environment, changes) and unstructured (rationales).
- When being interpreted, solutions have a structuring property. They provide agents with new and context specific meanings as well as providing keywords that may later be used as search terms.
- Meanings are individually and communally created. They are disseminated through the social interaction of Socratic questioning during mentoring and help giving as well as via solutions.
- Solutions provide clients' technical staff with access to organisational meanings. These provide stocks of knowledge to aid their own knowledge work on cases or to facilitate interaction with the case company's staff.

- Reading related solutions in a problem domain provides agents with contextually relevant shared stocks of knowledge so that knowledge workers have the ability to learn, as a by-product of their day-to-day work.
- Structures of signification move through a lifecycle associated with the introduction and use of the product lines to which they relate. Meanings becoming more defined as the underlying problems reoccur in different contexts allowing complexification of meanings.
- Structures of signification relating to a knowledge domain contain meanings at different stages of their lifecycles.
- Even though a meaning may have been used repeatedly it cannot be taken as completely defined because as a new context may arise that requires it to be refined. Therefore agents must always be open to the possibility that all meanings are malleable.

6.7.7 NORMS

- Organisationally legitimate levels of service are formally agreed with clients in a service level agreement.
- Clients' staffs seek to broaden the boundaries of what is formally legitimate by asking unrelated questions to the case study staff who must decide what they will accept as legitimate based on balancing other demands for their time.
- It was seen a legitimate to have every PSE keystroke recorded by the company so that actions were highly visible. This was used to inform inter-company interactions. Thus employees were comfortable choosing computer mediated communication to record client interaction.
- Work norms relating to choosing cases, documenting solutions and seeking help are based on the agent's level of experience and knowledgability.

- Knowledge workers are expected to take Severity 1 cases first and initiate contact with the client within 15 minutes of a case becoming visible in the case management system.
- After Severity 1 cases knowledge workers are expected to take the oldest medium severity level cases next.
- Knowledge workers see it as legitimate to ‘cherry pick’ both easy and specialist cases even though this is not organisationally sanctioned.
- Knowledge workers are expected to stay working on cases as long as possible where it remains within the department.
- It is legitimate to help another employee if one is available i.e. not currently taking a Severity 1 case.
- It is legitimate to ask for help when making no further progress on a case rather than continue working on the case.
- The reuse of others solutions in part or whole is legitimate, though the original work should be referenced.
- Knowledge workers were expected to link cases to solutions where they believe the case may be examined afterwards by others. In practice they did not link when they believed the case was closed.

6.7.8 NOVICE LIFECYCLE

- Novices develop some interpretive schemes by learning to identify which unfamiliar cues are important.

- The product support departments engage in ‘proactive socialization’ by providing feedback on performance, information seeking, as well as network and relationship building.
- Though the organisational objective was technical competency workers’ ‘representations’ were important in helping identify which PSE’s engaged in the documenting practice and which engaged in the case analysis practice only.

6.7.9 INTERACTION

- Corporate information systems enable ‘alignment’ of practices outside the arena of local engagement.
- Customer interaction was at ‘arms length’ providing little opportunity to build social capital.
- ‘Self serve’ technology, with information limited by PSE’s, resulted in: reduced information overload and increased agent knowledgability.
- Limiting the amount of information available to clients via the self serve web site was facilitated by PSE’s continuously taking clients’ perspectives.
- PSE’s first engaged in perspective-taking during interaction with clients and used this subsequently to, either individually or with a small ad hoc group, make a

perspective on the problem. They could then provide this perspective to clients when explaining what had happened.

- Mentoring and help-giving among PSE's facilitated the development of social capital at a departmental level.
- The importance of context for knowledge work limited the external intervention into knowledge workers sense-making activities by middle management.

6.7.10 DEFINING WORK AND NEGOTIATING IDENTITY

- Not only were managers able to negotiate their identity but this ability was also open to PSE's.
- Representations were 'local' to PSE's and operational managers but not directly visible to middle managers.
- For PSEs representations centred around a sense of self and around ones work.
- The 'problem solving' representations were more likely to increase employee visibility and improve promotional opportunities.
- Dissonance occurred through planned managerial interventions and through disruptive events.

6.8 CONCLUSION

The objective of this chapter was to describe how cases that arrive into the Level 1 product support department were analysed. The system required that each case either be linked to an existing solution or the need for a solution to be documented be recorded so as to identify areas for knowledge creation and codification. Thus tacit knowledge was of value if knowledge objects were insufficient, but organisational processes sought to use tacit knowledge only in novel situations while ensuring the novel quickly became routinised and available to all employees.

For PI-CORP the traditional perspective is feasible in large part because actions have ‘knowable’ cause and effect relationships. There exists a reality that may be discovered and empirically justified. An advantage for the organisation is that the existing knowledge objects can, in line with this approach, be embedded in solutions. These can be augmented by a strategy of managing tacit knowledge to keep pace with inherent incremental change. The value of PSE’s is twofold. Firstly, where there is a ‘sameness of contexts’ over time codified knowledge-objects can be transferred to PSE’s technical tacit knowledge as a by-product of their engagement with knowledge work. This saves time dealing with subsequent cases. Secondly, where the introduction of products creates new contexts in which beliefs must be examined, this requires exercise of intellectual capabilities by PSE’s through the creation or modification of knowledge-objects. Once a solution is discovered by PSE’s, the knowledge-as-object view advocates the codification and subsequent transfer of knowledge.

Regarding the tacit-explicit categorization in the literature the case company view is to support two of Jimes and Lucardie’s (2003) categories: firstly, that knowledge is explicit held in various repositories and secondly, that knowledge which is tacit can be formalized. Pi-Corp has specific organizational procedures to ensure this occurs. It is implicitly assumed that tacit knowledge can be formalized. This ability to codify knowledge is also examined in the (Zack, 1999a) framework that sees knowledge capable of articulation, and of value, should be made explicit to exploit knowledge. The disadvantage of not making solutions explicit is seen by Pi-Corp as a lost opportunity to leverage knowledge wasting time and resources if the problem reoccurs.

Even allowing for the contextual specificity of solutions, problems are not inherently inarticulable. The articulation of a solution may require an employee with sufficiently complex interpretive schemes and competencies to make it explicit. The company attempts to enable all knowledge transfer through information and communication technologies. It requires its employees, when writing solutions, to avoid unnecessary jargon and to write solutions that can be understood by its clients to further increase diffusion. This highlights the knowledge-as-object perspective that the underlying knowledge is transferable in an explicit format. Comprehension problems are seen as stemming from inadequate codification not that the underlying knowledge is inarticulable. The main focus of knowledge management initiatives in customer support fits the first two of Hendriks and Vriens (1999) alternatives. The right knowledge, is made available when needed to the correct person, and secondly the development of a corporate memory.

The tacit knowledge held by employees, because it is distributed among PSE's and embedded in solutions increases the power of the organisation over its workers as argued earlier in section **Error! Reference source not found.** by (Scarborough, 1999). Codified knowledge is seen as a structural organisational asset. However, attempts are not made to decontextualise as suggested by (McLureWasco and Faraj, 2000). The transfer of the knowledge to competitors is of little value as the knowledge is largely proprietary with monitoring software and error codes idiosyncratic and of little value to competitors. Some elements of context are structurally hard-coded into Clarify and Primus with rationales supplying what are felt to be the missing components. An objective is to minimise the need for subsequent contextualising tacit to tacit exchanges about problems. There is an organisational preference for explicit boundary spanning objects. A result of this 'knowledge-as-object' strategy is that there is organisational ownership of knowledge and the knowledge possessed by PSE's is largely specific to the case companies products: as such it is of little value except to clients.

The problem to be analysed was presented by drawing on an organisational taxonomy that presented information in a very structured way regardless of whether the source was system automated or human. Work was specialised and automatically allocated based on predetermined group competencies. Due to repetition of cases employee tacit knowledge was adequate in most cases to define the underlying cause of the problem. Where tacit knowledge was insufficient it was possible to search an organisational repository.

Tacit knowledge was required to ensure the solution fix procedure returned was appropriate to the context of the problem. The solution knowledge objects, if this was not the case could be modified developing more finely grained knowledge-objects. The objective was to only do this once to improve efficiency: through knowledge reuse. If an employee could not perform this action they could always draw on the tacit knowledge of others to analyse the problem. When getting others' help the objective of the firm was still efficiency: the case should be solved at the lowest (and cheapest) possible level. To avoid employees at Level 1 wasting time a time limit was imposed to ensure complex cases were escalated to the next level and ensuring Level 1 employees would spend analysing and developing a fix for problems. Even where fixes were developed their effectiveness was measured by how it supported long term organisational efficiency.

The above processes were heavily reliant on the knowledge management system and efficiency measured using a few core metrics. This monitoring was also present as employees effected fixes. Their actions were largely either interacting with systems or system mediated- even to the extent of every keystroke being recorded for subsequent examination later if required.

Tacit knowledge was used only in novel instances where knowledge-objects containing set procedures could not be re-used. However, by using the analytical lens of the practice-based-perspective other aspects of the process were brought into more stark relief. The sensitizing concepts outlined in Chapter 3 were found to be useful at each stage of the case analysis process.

Rather than viewing the call centre work in a functional, mechanical way it was possible to identify differing work patterns at a more micro-level as employees engaged in activities that helped them define their work and identities, producing varying representations of work and self.

Instead of viewing solutions and other types of organisational documents as static knowledge-objects it was beneficial to consider them as communicative genres. Rather than seeing meanings as pre-existing, awaiting discovery and codification it was possible,

even in an environment where cause and effect relationships were empirically identifiable with certainty (eminently suiting a positivist position), to examine how these meanings were stable only for a time at best and were continually reassessed and redefined through perspective-making and complexification.

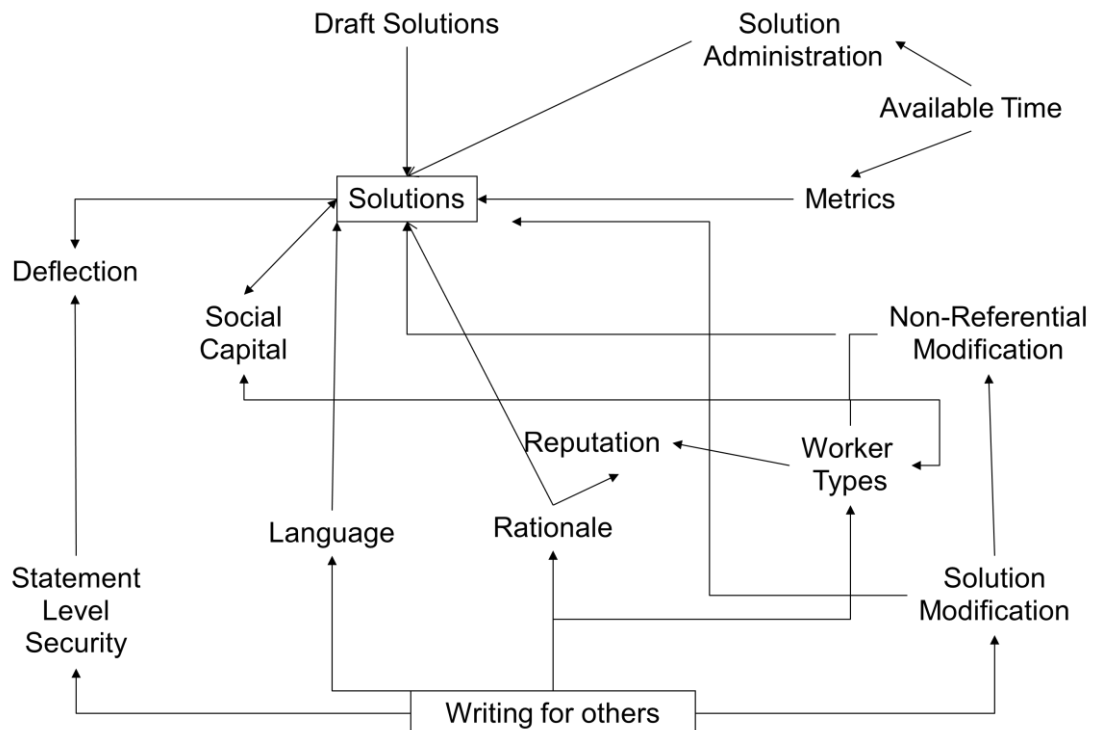
Norms too were open to interpretation as opposed to being organisationally mandated. It was beneficial to understand this perspective as variation in norms from those 'officially sanctioned' had unintended consequences. These consequences were found to have both positive and negative consequences that in either case could be better managed by accessing the reality of the norms as instantiated.

Rather than just categorizing the analysis of unique problems as the application of tacit knowledge to a codified problem more insight could be garnered by considering this process from the practice-based perspective.

7 THE SOLUTION DOCUMENTATION PRACTICE

Documenting solutions requires writing up in an objective and descriptive manner information gathered from various sources, what the employees have empirically observed, as well as the actions they and others have taken. From the objectivist perspective on knowledge management it can be argued that solutions are written to document ‘justified true belief’ about a problem, as it is understood by a knowledge team at a particular point in time. Solutions are based on series of actions that have been shown to work i.e. they have been justified. They provide a set of fields which define the context in which a solution was used, the required set of actions to be taken, along with any requisite rationales. Solutions are written for, and accessed by, different levels of users internally and externally. This chapter begins by analysing how the knowledge repository was populated. Next it considers those factors relevant to documenting solutions. Section 7.3 considers the factors that deal specifically with how solutions are drafted when they are to be read by a person who did not author them. Similar to the last chapter the final section outlines the main themes found to be present in this chapter.

Figure 35: Solution Documentation



7.1 REPOSITORY IMPLEMENTATION

An initial problem with the knowledge management repository was the need for a critical mass of solutions to be documented. System usage was initially low because of the small number of solutions available. The main issues from a traditional knowledge management perspective would be to populate the repository by documenting required solutions. Because the relevant series of actions to follow were known and already identified knowledge codification using solutions would not be seen as problematic.

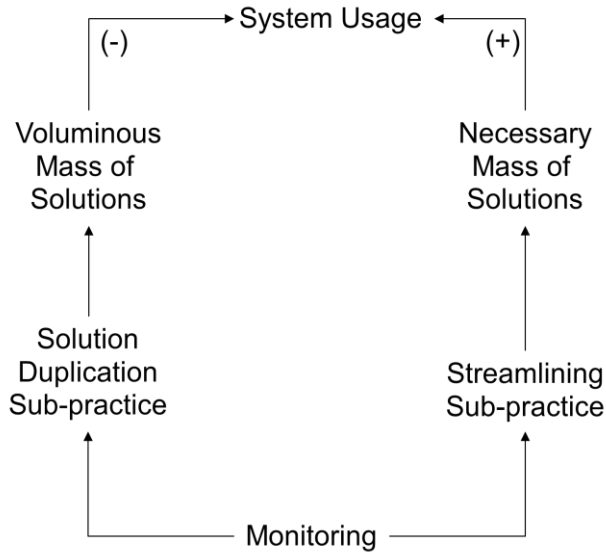
“I started looking at [Primus] expecting them to be badly written and bad processes and all this but found out that they ... and very well written ... we just didn't have the volume”

SOFTWARE MANAGER

When seeking to populate the Primus system with solutions PSE's were encouraged by management to write solutions. Departmental managers began overtly monitoring the number of solutions developed each month by members of their department. A sense of rivalry developed between managers in various call centre locations who as a result pushed their staff to document increasing numbers of solutions each month. This resulted in employees creating 'duplicates' of existing solutions. Instead of modifying an existing case in light of a new context (as discussed in section 6.2.2) PSEs chose to write a 'new' solution.

Over time it became more onerous to maintain the knowledge management repository. An unanticipated consequence was that a case in the case management system could be hyperlinked to any of the relevant existing 'duplicate' solutions, that could appear first in a search depending on the search terms used considered already in section 6.2. This made it difficult to identify solutions which were highly used in particular knowledge domains which would indicate areas in need of attention. Once these problems were recognized by an Irish vice-president there was an order to clear the database of unnecessary solutions. This initiative led to some departmental managers to become competitive again, but this time about how many solutions had been deleted from the repository by their group.

Figure 36: System Usage at Implementation



The repository was revamped by moving the task from product support department heads to the knowledge management manager who reported directly to a vice-president in Ireland. He interacted directly with knowledge domain team leaders with whom he had long-term relationships. He had a number of advantages in taking on this task. He was allocated extra resources in the form of six interns, computer science students from a local university on work placement. Their job was to trawl through what were thousands of solutions identifying likely duplicate solutions as well as those they thought were poorly written. These flagged cases were then checked by experienced team leads in the relevant knowledge domains. The extra resources provided allowed him allocate basic tasks to interns who identified duplicate solutions from the repository. Team-leads in relevant domains were asked to make judgment calls regarding whether solutions should be deleted, retained or to check identified cases met quality standards.

“a lot of the information was invalid people were just putting in what they believed was a fix to the problem when it really wasn’t valid. But now that’s all cleared up, they totally gutted the database and cleared up all the solutions and deleted solutions that weren’t were obsolete and not being used. So Primus is improving an awful lot.”

EXPERIENCED PSE

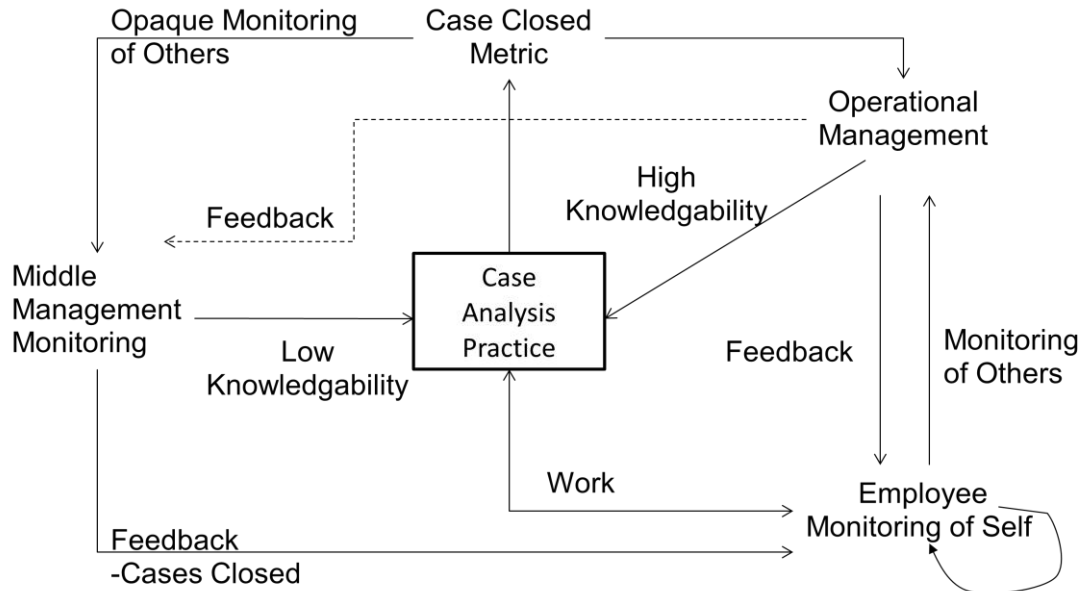
The knowledge management manager had another advantage: he was in charge of training people how to use the knowledge management repository during induction. In this position he had a chance to meet most of the novice PSE's in their first few weeks with the firm and was able to begin building relationships with them. He also had the benefit of having been promoted to his training position after spending a number of years as a PSE when the product support department was much smaller so that those employees he had not trained he had worked with as colleagues. While knowledge domains had developed since his promotion he nonetheless had an appreciation of what the work entailed.

With the primary metric monitored by management being the number of cases closed, and with time at a premium, there was no short-term incentive for PSEs to document cases. Documentation was beneficial in the long-run by reducing the time to resolution. The introduction of new informal metrics regarding documentation of solutions by managers were accepted by employees, who modified their work practices in response. An unanticipated consequence of this modified practice was that PSE's wrote solutions that were similar if not identical to existing solutions. This was because managerial emphasis was on creation rather than the modification of existing solutions.

Employees knew that managers were (1) interested in quantity but (2) were not sufficiently knowledgeable to assess the quality or necessity of solutions they produced. Though writing duplicates averted the risk of managerial sanction in the short-run it resulted in consequences for the long-run which could have been anticipated. The objective of increasing the number of cases was to make the knowledge management repository more beneficial as it would contain solutions to a wider range of problems. However, in an effort to produce a managerially acceptable number of solutions employees had developed a work norm that saw it as legitimate to modify existing solutions and using these to create ostensibly new solutions when distinguishing their applicable context would have been sufficient. While a strength of the knowledge management system was its ability to allow employees continually redefine contexts during the process of complexifying problem domains (section 6.2.2) it relied on the authors' professionalism in only creating new contexts when such a distinction was of benefit. In this situation employees' norms regarding professionalism was subjugated in their effort to satisfy managerial requirements and avoid sanctions. This situation is outlined below in Figure 37. This is followed by a

practice based analysis that culminates with a revised diagram (Figure 38) that indicates the additional elements that were found to be analytically useful.

Figure 37: Repository Implementation 1



This illustrates the importance of power in affecting PSE's use of work norms. The informal managerial metric was given pre-eminence above documented work norms that ensured the quality of solutions. Even though norms for writing and approving a solution were available, both employees and team-leads ignored these quality measures in an attempt to deliver to management the quantity that was required of them. This action, which created duplicate copies of solutions with inconsequentially different contexts, eventually resulted in an unintended consequence, increasing numbers of search results appearing when employees searched the repository. It made searches more time consuming. Though defining the relevant contents in which a solution could be used was an organizationally defined and accepted norm, at the time the importance was not stressed in practice. This illustrates how norms are not equal in importance and how their relative strength of rules varies over time.

Departmental regulation was supported through formal norms regarding the case analysis practice. There were norms regarding the number of cases that should legitimately be closed with sanctions where such prescriptions were not met. These existed as a structural constraint. The allocative authority of those in charge of the case management system used their command over this system to enable continual regulation by monitoring the

number of cases closed. However, this allocative authority over a material resource was limited to counting closures. It was concerned with the output of the case analysis practice rather than in the detail of its instantiation.

An acknowledged condition of the case analysis practice related to the asymmetrical distribution of power. Managers had authoritative power to command PSE's to undertake particular work and allocative power over system features to monitor work output. PSE's, as knowledge workers, held power to enact the case analysis practice.

The case analysis practice became increasingly opaque to managers the higher up the hierarchy one went. Agency requires knowledgability about others' actions as outlined in section 3.2. The hardware manager took a position that the case closed metric made him sufficiently knowledgeable about the case analysis practice and made him capable of monitoring the instantiation of that practice. He acknowledged that opacity existed. He freely admitted in discussions with the researcher he could not undertake the work completed in his department himself but he did not acknowledge that this was necessary for him to complete his managerial work.

The software manager, having being previously involved in the case analysis practice as a PSE possessed some mutual knowledge regarding the processes involved, though not an understanding of the current meanings that existed regarding errors. This partially shared interpretive scheme with PSE's allowed him to be open to augmenting his system mediated monitoring practice with 'operational management mediated monitoring'.

Operational management mediated monitoring refers to the monitoring of PSE's activities by knowledge domain team leads and also shift leads. These lowest levels of management were involved in analysing cases (they enacted a shared practice) and had a shared stock of knowledge with PSE's. Their monitoring of others in their team/shift was acquired both directly, as a by-product of the help-giving practice (discussed in section 6.3) and indirectly by continually observing the flow of others' actions. Regular interactions with PSE's over time, in a co-located space, provided the most detailed level of monitoring. This enabled feedback to department managers. This took the form of 'operational management mediation' where team and shift leads sought to place particular PSE's productivity in context e.g. arguing they had been working on time consuming and difficult

problems. Not only did PSE's attempt to affect the sanctions on their conduct but so did, where warranted, their operational managers so that the system enabled metric was not relied upon in isolation by managers but consideration was given to the difficulty of the work as well as to the number of cases closed in assessing an employee's performance.

In order to stop poorly written or unnecessary cases entering the repository much greater emphasis was placed in following existing organisationally defined norms for writing solutions and the procedures for quality checking them. These norms, though established early, were given greater importance vis-à-vis other norms in response to the duplication sub-practice.

The reflexivity exhibited by PSE's in the case analysis practice involved regulation towards an end, closing cases, that directly supported the departmental goal. Even the cherry picking practice supported this goal. The documenting practice, indirectly supported the departmental goal of closing cases by creating solutions that made case closure more efficiently in the long-run.

Operational managers and experienced PSE's reviewed the technical accuracy of solutions. In enacting this review sub-practice they could draw on organizationally developed norms outlining how solutions should be written. They were supported in this by knowledge repository system features which required specific inputs to sections of a solution.

When analysing cases the very existence of the problem was sufficient to warrant the enactment of the case analysis practice. The decision to document required an initial act of agency: judgment was based on the knowledgeability of the PSE regarding the need for a new solution to be created existed. PSE's were faced with conflicting demands regarding this new documentation practice. Their knowledgeability about problem recurrence meant that only a certain portion of cases needed to be documented. In other instances the modification of an existing solution would suffice. Still other cases were standard and capable of being closed by existing mutual knowledge.

Managers lacked the mutual knowledge required to evaluate the necessity for particular solutions. The problem of managerial opacity was reduced in the case analysis practice by 'operational management mediation'. Because of how work was allocated this was

possible in the case analysis practice but absent in the documenting practice. Operational managers reviewed the quality of solutions but not the underlying necessity for the solution. Though the system constrained what could be placed in a solution it enabled any solution to be created. This placed an emphasis on the role of PSE agency and their adherence to organisational structures of legitimation. Rather than argue against the need for increasing numbers of solutions to be documented PSE's follow the managerially defined norms for volume by enacting the duplication sub-practice.

For regulation to be binding i.e. embodied as a structural constraint, it need only cover a portion of a group where sectional interests exist. To avoid possible sanctions from heads of department PSE's reflexively examined their situation and the actions of others and decided to meet legitimated managerial targets by ignoring the corporate norm to create a single solution for each distinguishable problem situation. In doing this they knew that deviation from this norm, due to middle management opacity, would be difficult to monitor. They thus created a new, alternative norm within their sub-group.

This reflexivity on their situation was successful to the extent that it met short-run needs. Over time feedback to the social system occurred through what was an unintended consequence of action. The duplication sub-practice resulted in more cumbersome and lengthy searches during the case analysis practice. This directly affected, in a negative way, the long-run core work of the department. The effect of this would, if not checked, decrease the number of cases closed in a time period: a metric directly observable by department managers.

As the duplication sub-practice began to have negative consequences on closing cases awareness of this, by now, widespread practice reached middle managers. At this time the hardware manager's initial reaction was to monitor the number of duplicate deletions. He sought to retain the core elements of his own work practices which involved defining his work as monitoring by metrics and therefore only wanted to change the metrics used to suit the changing situation.

The vice-president was, like the rest of the department, monitored on the volume of work processed by the department. His actions to set up a support group under the knowledge management manager were an instantiation of the allocative and authoritative power

available to him. His agency was exhibited in reallocating the task of removing duplicates away from the middle managers whose opacity contributed to the development of the sub-practice. This move caused a new practice to be established with the knowledge management manager having the authority to institute new norms of behaviour with the cooperation of operational managers who saw the value of this change to increase their groups' long-run productivity. By removing department managers, and their expectations, the conflict felt by PSE's between group norms and the new middle manager legitimated norms were removed.

Once the system was rectified department managers were reintroduced and could now espouse the new norms. While Structuration Theory accepts agents are capable of acting otherwise by exercising power to influence others and specific processes, middle managers held back from 'doing otherwise' because they recurrently drew on a structure of legitimation that was, for them, deeply sedimented over time. The existence of a punctuated break allowed them to discard one structure of legitimation in favour of another.

This showed how rules were extended to suit a new situation. Due to the connected and overlapping nature of rules, along with heterogeneously distributed knowledgeability and power, a few individuals with authoritative power could force agents who had a choice of conflicting rules to chose to put aside formally mandated norms.

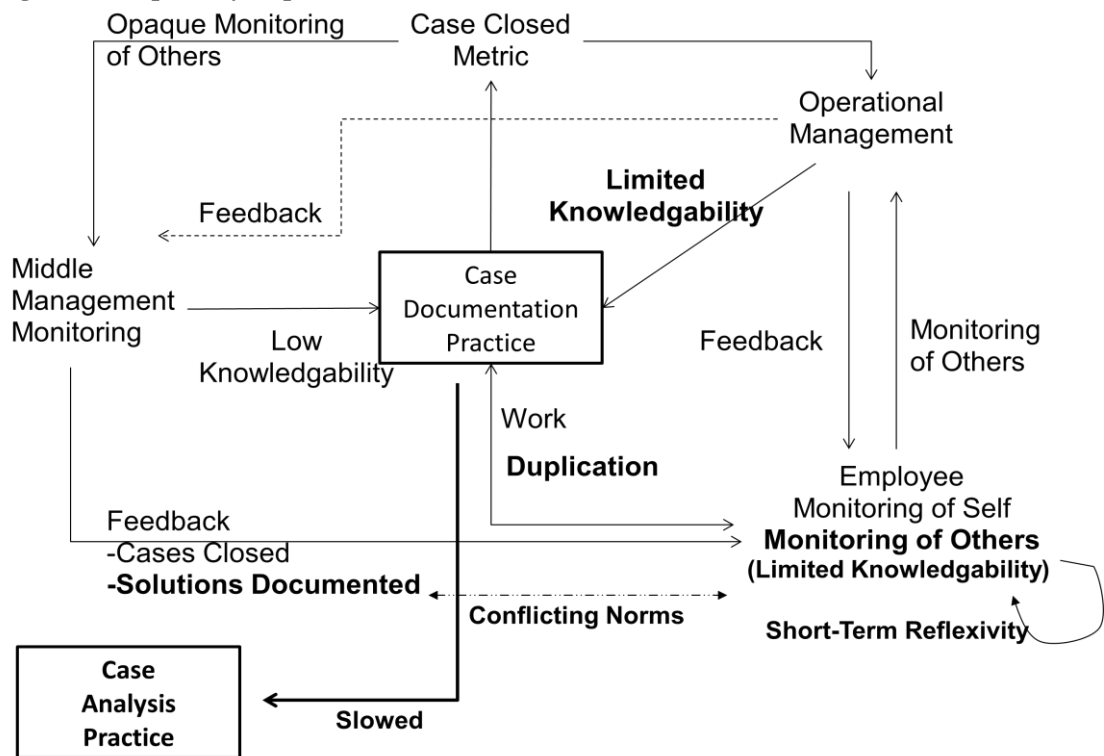
As well as being outside both product support departments the knowledge management manager suited the task because of his background: he was able to exercise agency by drawing on his knowledge about the circumstances of the others' actions. His partially shared stock of knowledge with PSE's was bounded and shaded off regarding current meanings, but was sufficient for the task. These necessary qualities allowed one individual to exercise the agency and change what was still a new but recursively instantiated practice.

Reflexivity involves continual monitoring. This may occur over different time horizons. Agents used short-term reflexivity when considering the rules to draw upon in a particular context. They make this choice based on the immediately recognizable consequences of their actions which allow them 'go on' unhindered in the present flow of work. Conditions

of action may be unacknowledged at the time rule sets are chosen in the short-run, but can be surfaced and acknowledged if the agents reflect on the implications of their actions over a longer time horizon.

The number of solutions in incomplete or draft format was monitored after the repository was revamped. This was done by the knowledge manager who focused on the maintenance of an ‘appropriate’ number of solutions by providing informal feedback to operational managers in any areas of concern. Figure 38 below illustrates how the practice based analysis has allowed Figure 37 to be augmented.

Figure 38: Repository Implementation 2



7.2 REPOSITORY SOLUTIONS

In the hardware department the cause and effect relationship between the underlying hardware error and the Primus solution is more clearly defined than in software. It is possible to associate errors with very specific pieces of hardware and therefore an important factor in the hardware department is the development of a fine grained taxonomy which can be used to classify errors and Primus solutions. This is beneficial by reinforcing

standards and offering PSE's more defined meanings. It reinforces the specific words that are used and their associated meanings.

The hardware department has an added advantage over software in dealing with knowledge work as it is possible to schedule a customer engineer to replace a specific part or parts even where an underlying cause for the problem was not identified. This means that work can sometimes be completed in hardware even where a solution to the problem is unknown.

Cases in the software department are more ambiguous. From the details in the case management system it is possible to see the client configuration and the software product code level the customer is running. Information from a third party regarding their software may be relevant to detail how the case companies products have been customized. This complex environment can make previous solutions inapplicable over both time and contexts. The nature of the underlying knowledge work makes the 'knowledge-as-object' perspective eminently suitable.

Each day team leads and department managers have a turnover meeting where particularly difficult cases without solutions encountered the previous day are discussed. Decisions are made at this meeting to allocate PSEs to document particular problems. The knowledge domain team leads would already be aware of such problems, having sometimes been involved in their solution. They know the personnel who were involved in developing the fix and who is best positioned to author the solution.

With the implementation of a knowledge management repository a new resource was made available to support the case analysis practice. It required a new solution documentation practice to be developed. The repository exhibited structural properties that both enabled and constrained PSE's. The system configuration and its associated work norms were developed centrally. Norms were outlined regarding the legitimate inputs to parts of solutions. The configuration and environment tree resources contained the range of signifiers used to denote phenomena across groups, while enabling and reinforcing an organizational taxonomy.

7.2.1 DRAFT SOLUTIONS

The proportion of solutions held in draft form varied from 4% to 25% between groups leading to an organizational average of 9-10%. The proportions of draft cases were not uniform over the various knowledge domains. This indicated a need to either rebalance the number of employees in knowledge teams to cope with areas experiencing pressure, or alternatively a need to spread documentation practices from teams with low proportions of draft cases to those with high numbers of draft cases in the department. The former is less likely because there was a certain level of redundancy in the system: all employees had general skills and could take standard cases in any domain.

“[The KM Manager] kind of works with them as much as he can and use their practices and pass them on to others.”
SOFTWARE MANAGER

At the time interviews were conducted there were discussions about how to structure case documentation within the product support departments. Having this as part of each PSE's daily work had led to a large number of solutions existing in draft form. The knowledge management manager and one particular mentor interviewed believed that it would be more efficient to have a small dedicated team to document solutions and finish drafts that could then be quickly reviewed by area specialists and given 'full' status. The view of the relevant specialists was that documenting solutions required their expertise and could not be done by others. While the knowledge management manager had previously been a PSE it was believed by the current PSE's that, because of the changes in the knowledge domain, even he would not be capable of documenting solutions.

The knowledge management manager went through a sample of draft cases and, using the annotations provided in the case management system, wrote solutions which he then had reviewed and corrected for technical accuracy by domain specialists. His argument was, given that relevant information was already available in the various information systems, created while analysing the case, it was possible for the documentation process to be completed by people with a basic understanding of the hardware and software domains. Any technical inaccuracy could be picked up at the quality review stage by experienced PSE's. He argued that it would be more efficient to have a dedicated group of solution

writers because this would be their only task. They would not have this task interrupted based on the composition of the current case queue.

A different option was to have a dedicated team of PSE's to write solutions but have a separate support group of technical writers to work on the grammar and syntax of the solutions so that they were polished and unambiguous before being made available to product support and to customers. This shows that the way work is performed is open to several possible reconfigurations where slightly different objectives were given pre-eminence.

7.2.2 SOLUTION ADMINISTRATION

Some employees used to make a note on a piece of paper of the case identifiers for difficult cases that they had to escalate. Later they checked these identifiers so that they could learn how the case had ultimately been solved. Though it did not support their immediate work, closing that day's cases, the tracking practice increased learning. This 'paper tracking' practice supported workers in increasing their understanding by learning more about how difficult cases were solved by accessing case details afterwards. These documents could only help the employee to the extent that they were able to understand them as they were developed by, and written for, higher levels.

This informally developed practice increased the relevant employees' ability to solve cases. This sub-practice was not enacted by all employees. Intrinsic motivation to follow up cases, coupled with the ability to 'create time' to engage in extra activities not of immediate value in the short-run was required. This practice increased long-term productivity and ultimately stopped cases from being escalated. One particular employee had become unhappy with trying to keep track of cases on paper and instead had written an application to track case details electronically. Colleagues in his work group asked for copies of this application so that they too could keep track of certain cases to view their solutions after a final fix had been found.

The transfer of this practice to an electronic format depended on the agency of one employee, whose reflection of current informal practices and his existing experience enabled him to develop the case tracking application. The knowledge domain team developed this practice by using it recurrently, in their day to day work.

From an organisational viewpoint solutions were knowledge objects to be located and applied as needed. Their absence was indicative of a need to escalate a problem to a higher level. This limited the skills needed by a Level 1 employee. The development of this informal practice allowed these workers to gain insight and learn more about cases that they had previously had to escalate. It had the effect of increasing the ability of employees at the lowest level to close more difficult cases by means that were unknown to management.

7.2.3 METRICS

Senior managers' bonuses and job security were based on how the firm's product support performed against industry metrics. Their objective was to provide an agreed level of service for a pre-determined cost. The primary metric of concern to employees was the number of cases closed. Short-term variation in this metric was expected when difficult cases were encountered. Using the case management system employees and managers were able to monitor the number of cases closed. Individuals could see their own total and were able to compare this to their shifts average. Managers could see the total for each employee. Employees had the capacity to make themselves unavailable for phone calls when working on the Severity 1 cases or trying to close a multiple cases from their work-in-progress folder. Employees were also aware of the number of phone calls waiting to be answered. This figure was displayed prominently high above the open plan partitions on an LED board. This metric was important in helping employees decide the composition of cases in their workload.

The 'cases closed' metric was treated differently by the hardware and software managers. The software manager, who had been a PSE, was careful to discuss individuals' low numbers with team and shift leads to identify the difficulty of the cases the employee had taken. When this was not a factor more mentoring was provided for the employee. He

was also careful to make employees in his department aware of what was expected of them in terms of performance, particularly when this changed as they became more experienced.

The hardware department manager had been hired from outside the firm into a management level position and never been involved in the type of knowledge work carried out by his employees. For him, metrics were paramount and provided an objective and effective way of doing his job. He was quick to take action by calling under-productive employees to his office. Even when employees explained that their apparently low performance was caused by a few difficult and time consuming cases there was a feeling that he did not fully appreciate this because he lacked an understanding of the minutiae of the inherent knowledge work. One way employees found to cope with this behaviour was to ‘cherry pick’ their cases to keep their numbers high. It was easier to start the day with a number of easy cases and create a buffer in case time was lost later in the day. This ensured productivity never fell to a level which would attract the managers’ attention if possible. To increase the number of solutions documented both ‘soft’ encouragement and ‘hard’ metrics were used. Even though employees were known to respond to defined performance metrics prior incidents were still fresh in everyone’s minds regarding the race for solutions.

“We’re trying to encourage it, [documentation of solutions] we’re trying to reward it, trying to metric it and like it’s funny in any environment if you tell people I’m measuring you they’re either going to have 5 solutions created every week, I’m pretty sure people will link the metric I think for quality.. they’ll play with every metric but it’s funny you can change behaviour quite quickly with the metric if you start publishing and stuff, so that’s something we try not to do too often. They’re cunning people!”

SOFTWARE MANAGER

While it was recognized that employee behaviour could be changed by introducing new metrics, there was concern regarding the unanticipated consequences of this action. Managers were worried what actions employees might take in an effort to meet their metrics. This was problematic because even though almost all at a lower and middle management level had worked in the area their ability to judge the necessity and the detail of a proposed a solution was at best, opaque to them.

One report used by the knowledge management manager examined the number of solutions in each knowledge domain. Solutions were categorized by whether they were finished or were in draft format. This report was not automatically generated but needed to be specifically requested each time by the knowledge manager. He found that the proportion of solutions still in draft format varied considerably by knowledge domain though the aggregate figures for the customer support department were in line with industry benchmarks.

A factor that militated against refining solutions was the time available to employees. The case closed metric was designed to keep employees working and productive throughout the day. ‘Cherry picking’ (already touched on in sections 5.2.2, 6.5.3 and 7.3.5) enabled PSE’s to make space during the day to balance their workload. The main time for documenting solutions was after 15h00 until the end of the shift at 17h00. This was because the US call centre went live at 15h00 allowing PSE’s to stop taking incoming cases. They used this ‘wrap up’ time to close cases in their work in progress folders as well as documenting solutions.

7.2.4 AVAILABLE TIME

A feature exists in the case management system that lets employees identify that a case requires a solution to be written. It is possible for an individual to say no to this automatic system query to avoid having to write a solution, even if they know one is required. This may occur in a medium level severity case. In more difficult cases, where help is given, the severity of the case will mean it is brought up at the turnover meeting the following morning. Additionally where difficult cases involve a number of employees it is difficult not to classify the case as requiring a solution, when others are aware of the problem.

The volume and composition of the case queue is the main factor influencing how employees can order their day.

“if you do come up with the solutions given the time yes you should put them in and document them. [if the queue us busy] You can’t do it, I mean you know you have an hour and a half maybe in the day or an hour in some cases to clear up what you’ve been doing for that.”

NOVICE PSE

A number of issues were highlighted regarding this process. Not only did time pressure delay writing solutions but it also delayed their approval from draft to full status.

Finding time to engage in the documentation practice required agency. Not only was the composition of the case queue a factor, drawing on norms regarding severity and duration, but even where severe cases existed and knowledgability and availability of others affected the decision to leave a case in the queue to others. PSE's command over system features were relevant as the creation of a draft, as a placeholder with no content, placed the activity 'on the radar' as work in progress.

Temporal patterns of action between call centres provided a useful structuring property for documenting. Towards the end of the day the norms regarding severity and duration changed. This temporal structuring allowed time to work on important activities like documenting cases without the pressure of the case queue.

“But I suppose at the end of the day the calls coming in are our biggest inhibitor to a good knowledge centred support.”

SOFTWARE MANAGER

A problem with delaying writing solutions is that it was possible for the volume of incoming work to result in the PSE forgetting to ever document a case that they had identified. While there is a warning mechanism in the case management system to remind employees of current cases in their work in progress this feature is not replicated in knowledge repository for solutions required or in draft form.

“You know the Primus solution is kinda cutting at the back of your mind thinking that you'll take care of it later on and then it goes to tomorrow, and I'd say eventually a lot of stuff gets forgotten sometimes that way as well. I know there was one from last Thursday that shouldn't have been.”

EXPERIENCED PSE

7.2.5 DEFLECTION

Standard customer queries were deflected as customers used the product support web site. This had the effect of increasing the difficulty of the remaining cases. This in turn would

require employees to possess higher levels of problem solving and diagnostic skills. These expectations were communicated early in the development of the customer support site in an effort to give employees who ‘cherry picked’ the straightforward cases the time to develop their interpretive schemes and capabilities to cope with more complex situations. Increasing the proportion of difficult cases in the work queue means that, over time, the volume and detail of cases to be documented would also increase. While emphasis was placed on preparing workers for their primary problem solving practice, little was said regarding the consequences to the documenting practice.

Even when a client cannot solve the case themselves the fact that they have access to the repository is beneficial to the product support department. Before speaking to a PSE the client knows an existing solution is not readily available. This increases the perceived value of the PSE’s ability to analyse and solve cases. They are seen as having a higher level of expertise than typical call centre workers who follow very tightly scripted interactions with callers as discussed in Chapter 5. In situations where the client uses the website to locate a number of possible solutions their own understanding and ability to help in the case resolution process also improves. Solutions can outline actions that can usefully be taken by customers to help subsequent PSE analysis (see Figure 8 page 148). Solutions may also aid learning by outlining questions and providing a more general explanation rather than just a fix procedure (see Figure 39).

Figure 39: Using Solutions to Aid Customer Learning

<p>Question: What is the significance of a coherency error on a PI-CORP Hardware array? ... Problem: Sniffer is reporting write stamp errors associated with coherency and parity errors. What do these errors mean? Problem: Write stamp errors ... Example: <![CDATA[Backend Event Number 0xa4b Error Host SPA Storage Array APM00072100039 SPA Device Bus 3 Enclosure 3 Disk 7 SoftwareRev 6.24.1 (5.0) BaseRev 3.24.0.80.5.014 Description The array has detected a coherency error. On parity units this indicates a mismatch. Fix: The design of the PI-CORP Hardware arrays allows for multiple levels of data protection. PI-CORP Hardware arrays format data being written to individual disks using 520 byte sectors instead of the more traditional 512 byte layout. PI-CORP Hardware arrays use these extra 8 bytes to store a time stamp, a write stamp, a shed stamp, and a checksum, all of which are used in various ways to ensure the integrity of the user data...</p>
--

A more informed interaction about the problem with PSE's can take place; and the PSE's, by being able to take more understanding from the available documentation have their expertise and authority legitimated through their ability to use these documents.

7.3 WRITING FOR OTHERS

By giving customers access to solutions PSEs engage in 'external sense-making' as described by Cramer et al. (2006). A key issue identified by (Markus, 2001) in her literature review of knowledge re-use was the degree of similarity between those who produce documents through which knowledge is transferred and those who subsequently re-use them. In writing a solution for others PSEs are making explicit the result of the case analysis sense-making activity through which their perspective on the problem was developed. When engaging in the documenting practice the writer must consider more and less specialized audiences. These other audiences draw on solutions as part of their own sense-making activity when initially diagnosing cases in their own companies. Authors should be concerned about subsequent perspective-taking even within their own team. Client staff may only have a basic knowledge of the company's products while solutions may contain localized specific knowledge.

Employees are aware when documenting Primus solutions that they are writing for others. The most similar category are other Level 1 product support employees, both in Ireland and in two other call centres around the world. Language is not a problem as both other product support locations have English as their primary language. Language may be problematic for customers' technical staffs for whom English may be a second language. This necessitates a writing style that is as simple and direct as possible but which must adequately describe the complex subject matter. A balance needed to be struck between devoting a large amount of time to making the solution more readable and professional and the value of making a solution available to customers as quickly as possible.

Some interviewees took the view that because those externally accessing solutions were from a technical background the syntax and grammar used for other Level 1 PSE's is sufficient. Where necessary solutions are 'versioned'. The knowledgability of others, affects PSE's ability to know when, and importantly when not, to use the fix. Versioning is

an attempt to augment various groups' knowledgeability with further rules regarding how and when to go on. They may request a customer to contact product support if the problem was particularly difficult or mission critical (Figure 40). When commands required for a fix have serious repercussions these can be outlined in a solution as seen below in Figure 41.

Figure 40: Reference to Customer Support Department

Fix: If alerting to PI-CORP is not enabled, contact the PI-CORP Customer Support Centre or your service representative for technical assistance and quote this solution ID. Intervention from PI-CORP technical support personnel is required.
Possible actions:
PI-CORP Customer Support Centre has been notified of the problem but a case will not be opened. Contact the PI-CORP Customer Support Centre or your service representative for technical assistance and quote this solution ID. Intervention from PI-CORP technical support personnel is required. Centera Support personnel must access the Centera to resolve this issue.

Figure 41: Warnings Contained in Solution

Note: The characters that must be typed are o p t i o n s = - p [space] 0 x 8 0. ... Caution! If this is an upgrade, do NOT remove the old nsrladb folder during uninstall; doing so will cause authentication problems between the server and the storage node.

7.3.1 LANGUAGE

Solutions are checked for technical accuracy as well as to ensure they meet documentation standards. Some employees felt that these norms were not strictly followed.

“Like I mentioned in Primus, when people are creating solutions it’s far too subjective they need a format for people to follow strictly so that information that’s provided the basis of what information you need to provide and information to fix the issue. A lot of it is casual conversation, it’s meant to be a technical document but it’s not really.”

EXPERIENCED PSE

In order to be able to write a solution in a manner that is comprehensible the PSE must not only write at their own level of understanding that most make sure it is understandable to those with less knowledgeability.

“say I issued such and such a command A.Charlie comma something you know you don’t ever say that like because it’s useless I mean, the person that will read it will be the customer engineer and they won’t have a clue what that command means so it’s pointless.”

EXPERIENCED PSE

Initially employee writing styles led to an over use of jargon making solutions difficult to use by those less knowledgeable. Various groups within the organization developed different terms for entities and events. This occurred not only in software where descriptions of events might be more ambiguous, but also in hardware where knowledge teams used different names for pieces of hardware and products. In the case of hardware and storage device could be referred to as the ‘cab’ (cabinet) a box, a red box- designating the box’s colour, or a yellow box, which referred to the colour of the lettering on what could be a red box. Some solutions not only provide error codes but included meanings and notes giving more details as evidenced in Figure 42.

Figure 42: Definitions in Solutions

<p>Root Cause: Description of events: 6A0/820 - Soft Media Error. A bad or marginal data sector has been detected. The sector was successfully read. 801 - A SCSI operation failed and needed to be retried. The error indicates that the retry succeeded. 901 - A SCSI operation failed and needed to be retried. The error indicates that the retry attempts failed. Note: 801 and 901 events are not strictly confined to being a disk-related problem. Soft SCSI errors can be an indicator of a bad LCC cable or bad LCC not handling backend bus loop noise correctly. Look at the extended status (described in the Fix statement) for the affected drive to determine the cause of the event.</p>

The knowledge management system handled idiosyncratic terms through the use of ‘concepts’: a number of synonymous terms could be grouped together and taken as equivalent in Primus searches. The time and effort to remove and rewrite such cases, undertaken by interns with a number of experienced employees (section 7.1), made the group more insistent that previous problems would not reoccur, making documenting and quality checking practices became more rigorous. Solutions were written by the least costly level of employee with the language being checked, requiring less time, by more experienced and more expensive employees. A potential bottleneck in this process is the time available to experienced employees to proof-read draft solutions.

Through recurrent readings PSE's became accustomed to using particular meanings in searches and when documenting solutions. This had an unanticipated consequence. Employees could at one time use a term to successfully find a solution but, when that solution had been cleaned up or modified with terms replaced, would become frustrated as the same search terms used in a subsequent search would not locate a solution that they knew existed in the knowledge management system. These changes led to a temporary breakdown in recurrence- contexts were no longer seen as 'the same' over time. It also illustrates an example of 'punctuated' change occurring in meanings.

"who ever wrote the solution initially might have different wording or whatever and it just mightn't take it up... it doesn't come up because somebody has tidied up Primus and it's just worded differently and you don't know where the solution is and it can be sometimes impossible to find that solution. It [experience] definitely counts, definitely counts, you'd actually know the words that will bring up a solution and the words that won't, which it should never be that way like but that just seems to be the way it is."

EXPERIENCED PSE

7.3.2 SLS FACILITY: KNOWLEDGE SEGMENTATION

When writing a solution, PSE's can use the Statement Level Security (SLS) facility to decide who should be allowed read certain parts of a solution. This allows each statement in a solution to be visible to a certain level of reader so that, for example, sensitive comments are only visible to employees. Solutions are written in discrete sections so the narrative still makes sense to people at different levels who read 'their' version of the document.

The statement level security capability can be used to help protect the company's reputation. The solution needs to be written so that it is as readable and useful as possible to customers who should still be able to make sense of the solutions visible to their level.

"Well we're encouraged by default when we're creating a solution that it's customer applicable so there's more customer related Primus solutions written than I think then more internal ones... Like instead of pointing the knowledge base inwards towards us they started turning it around so it's pointing towards the customer and you know they can answer, they can retrieve a lot more information."

SHIFT LEADS

There was a norm of avoiding the use of statement level security unless it was necessary. Hiding available solutions had to be balanced against the advantages of case deflection by customers and lower levels of product support. With the introduction of a website which provided customers with access to solutions there was a need to reset statement level security authorizations. Thus the capabilities made available by the introduction of new systems changed work norms.

Those employees who wished to deepen their knowledge of an area would later look up cases that they had escalated to a higher level of product support to see the analysis of the underlying problem as contained in its solution. However because of statement level security they could find this learning opportunity diminished: they could be denied access to the full solution. This limited their ability to develop their interpretive scheme in specialist areas due to the agency of others at a higher level of authority and expertise.

An employee may decide that it is safer to restrict access to only their support level rather than provide a more detailed description of the relevant rationale given the time required to write for use by others, even other departments. Thus statement level security was used to stop interdepartmental reuse.

“Yeah [SLS statements] that’s for mostly customers. Just so the customers don’t see some of the fixes and then the hardware lab mightn’t want people in the software lab to see some of the fixes which have to be implemented cause that means that the software lab could connect not really knowing or understanding what they’re doing. [regarding PSEs]You’re kept away for your own good.”

EXPERIENCED PSE

There was frustration among employees when they felt that information, which could help them do their job, was not made available to them. Some argued this was ‘hoarded’, by those at higher levels in the organization. This lack of information limited their ability to learn in instances where a case proved too difficult and had to be escalated to a higher level.

You can also be held "over a barrel" because of people hoarding knowledge. You can spend hours of your time trying to create a solution yet you can know that someone in the company knows the answer. This hoarding is mostly to do with the engineering department. The engineering department includes "prima donnas" who will hoard what they know due to the power it gives them and also relates to their

"arrogance". Yet if the engineering department gave more detail out then it would make their own life easier. There are only a small number of people at this level.
PSE= INTERVIEW NOTES

"some people just don't like to share information, it's that widespread now by any means but obviously you see an issue and it turns out to be a big bug and it starts affecting all the customers you should be required to share that information in the right format into a Primus solution."
EXPERIENCED PSE

7.3.3 RATIONALES

Figure 43: Providing Wider Understanding

Root Cause: The PI-CORP Hardware backend UltraPoint architecture prevents one failing drive from affecting other drives unless there was some other type of failure.

There are two advantages of allowing a disk to be put on probation multiple times:

If this drive was an ATA drive that became inaccessible for short durations due to bad block remaps, the probational state gives the drive a chance to remap the bad areas instead of having the drive power down when bad sectors are first encountered...

However, it is possible that the drive may fail later for other (non-probational) reasons. A proactive spare can also be allocated for this problematic drive if appropriate. While copying data to the proactive spare, the drive may take errors. In this scenario probation is not considered. ... A hot spare can now swap in.

Rationales explain the underlying problem and how the actions taken in the fix section solve the problem as well as the context in which a solution should be reused. They may also explain the distinction between similar solutions and hyperlink to other more appropriate solutions or third party documentation that help readers find the correct solution in distinguishable contexts. They are an elaboration on the problem that the writer feels is necessary to ensure the reader understands the meanings contained in the solution and its boundaries.

Given the importance of reputation for the author (section 7.3.4), as well as accountability for their solutions, if there is a subsequent problem with a case the rationale also acts to limit the writer's potential vulnerability where a solution was used in an incorrect context due to a reader's insufficient understanding of the area.

“they’re releasing new products all the time that has the NAS code on it the data code which we worked on so the original numbers are still up there and they’re adding to it every year and you know it’s going up all the time with the amount of boxes that are up there.”

SHIFT LEADS

While not a planned part of the knowledge management system rationales enable learning to occur as a by-product of work. They enable others’ stocks of knowledge to become complexified without social interaction occurring where sufficient mutual knowledge already exists. When this is not the case the rationale enables identification of a specialist within the department as well as enabling a more informed and efficient discussion of the problem when interaction is necessary.

Rationales, according to the knowledge management manager, may be considered as a way of documenting a learning process. The employee may also rely on annotations to understand others’ modus operandi and see how others made mistakes in analysing cases in order that the reader may avoid them. The rationale can also identify where less experienced team members could potentially go astray in their own analysis and help prevent such an occurrence. Where there has been help given the document may be jointly authored, describing not only the destination, (the fix actions), but also the journey of learning (rationales) that took place. The presence of a less experienced employee when authoring can result in a better solution by highlighting meanings that more experienced help-giving employees may have taken for granted.

There are organizationally established norms for documenting solutions. The rationale, intended as part of the fix is open to most variability. It does not formally exist and is only present when the employee feels it is necessary, an example of agency. This interpretatively flexible sub-section provides a window for a PSE to glimpse the emergence of another’s train of thought.

“if you read the case you will find out who was full of bluster about it, and then who is the big guy (who was all about it, knows it all) and then who is the geyser with the punchy stuff that got it (the answer/solution) ... you know and you remember them.”

EXPERIENCED PSE

The rationale provides a mechanism for virtual knowledge transfer relating to how contexts are defined and redefined. This can act to develop in employees more nuanced interpretive schemes.

The type of change the product support department faces, being incremental, does not so much make existing solutions obsolete as it makes them a distinguishable instance of a wider knowledge domain. It was suggested that a more efficient way of transferring this knowledge would be for higher levels of workers, with more understanding, write elements with as much detail as possible as the underlying code is being developed. Product support employees could use these as the basis for further elaboration in specific contexts. Thus, by the Engineering department providing some element of rationale the company could overcome the charges of knowledge hoarding, outlined in 7.3.2.

“I find that people who arrive at solutions don’t know enough about what is actually happened. Like, an engineer has designed the piece of hardware and he knows exactly what’s going on but the person writing the solution has seen the problem from a higher level and understands the problem from a higher level then say the engineer would so the solution can be maybe particular but sometimes they’re mixed up and it kind of gets, when someone else is following that solution they’re not following it for the right reasons. I see that happen a lot. I don’t like to write the solutions myself cause I feel that I don’t know enough about you know, I don’t have access to the information that, like I know someone who could write a solution better because they designed it, they know what that law is, they know why this piece of hardware failed.”

EXPERIENCED PSE

Thought not a formal part of a solution, the informal practice of including rationales by PSEs improved the accuracy of solution identification and re-use as well as increasing learning among Level 1 employees.

7.3.4 REPUTATION

By authoring solutions employees used the system to increase of their visibility within the department. Over time readers developed an understanding of the various authors’ specialties. This was particularly valuable where authors reside at another location. It was useful when an employee has to hand off a pressing and difficult case to another time zone. Rather than just place the case in their team’s relevant work queue they could instead

make contact with a relevant specialist in the next time zone and discuss the case with them. This ensures an efficient transfer of difficult cases by relying on a social knowledge of others in the wider knowledge domain team. For a small group of PSE's the system increases their visibility, while for the vast majority this visibility increases their knowledge of others specialties.

Not only is reputation important to individual employees but it is also important organisationally. Because solutions are available to customers their quality reflects on the company's reputation. This reputation supports employees when interacting with customers. The use of an existing solution gives the customer more confidence in the fix to be implemented.

There were no financial rewards for writing solutions. Non-monetary rewards did exist, because in creating a document that would be widely used by their peers with the author's name attached the author's reputation increased and enhanced. This peer recognition was seen as intrinsically valuable. Visibility to peers raised questions of confidence among some PSE's regarding their own abilities. Writing a solution that was correct opened their wider knowledgeability to scrutiny from peers as outlined earlier. Some focused on the negative consequences of poorly developed solutions, preferring their reputation be defined in terms of on their ability to analyse cases. There was also a view that saw the documenting activity as simply another process associated with their work. This was reinforced by managerial metastructuring of work norms. This new practice was accepted as an extension of the old practices and part of moving to full participation in the knowledge domain team.

Employees' sense of satisfaction and reward were also derived from their interpersonal interactions with client's staff. In one instance the employee of a client had accidentally deleted sufficient company data to warrant being fired. However, the data was recovered after twenty hours work by the case company employee, which, while devastating their case closed metric had brought gratitude from the client employee of whom they have been working closely and whose job they had effectively saved.

An acknowledged consequence of writing solutions is the increased visibility within the firm because of an author ID being present in solutions. This feature supports the ‘virtual monitoring’ of others indirectly as a by-product of the case analysis practice. Peer as well as middle and operational management monitoring is facilitated. The process of perspective-taking while reading solutions allows the reader to gain some insight into not just an objective set of facts but also, because the inclusion of more subjective elements, a glimpse of the authors knowledgeability.

This virtual monitoring of others helps locate specialists. It thus facilitates the help-seeking sub-practice. Both the virtual and physical monitoring that occurred during help-giving allowed newer PSE’s to develop social networks within the department. These were used to choose specialists not only based on their ability to solve the problem, a prerequisite, but also for their ability to co-author and help socialize the novice into the documenting practice.

Self monitoring occurred as PSE’s sought to manage their reputations. Not only did they monitor the quality of their work but they were also concerned that ‘their’ solutions were modified correctly. They were interested in feedback on their work as this could improve their solutions. In the case of problematic non-referential modifications: these could negatively affect a PSE’s reputation as outlined in section 7.3.7. Problems with solutions required post-mortem analysis at a higher level when subsequent usage caused problems for a client. This may have been due to ambiguity in the solution with meanings incorrectly interpreted by the modifier. The modifier may have overstretched themselves, going beyond the limits of their knowledgeability. The subsequent post mortem interaction was not just about fixing the solution but also about fixing reputations.

From the traditional perspective outlined in chapter 2 if solutions were written objectively to outline empirically observable actions then their authorship was irrelevant. In practice solutions provided employees with an understanding of the author’s reputation in certain areas; their strengths and weaknesses which may be drawn upon when deciding from whom to seek help. They also illustrate how employees are constantly monitoring, sometimes without explicitly realizing it, their social setting even as they complete what may appear to the organization, as individual work tasks.

7.3.5 PRODUCT SUPPORT EMPLOYEE TYPES

Taking the traditional view of knowledge management (chapter 2) the firm can be seen as having different types of employees who can be categorised by their degree of knowledge specialisation, departmentally by hierarchical levels of knowledge support and departmentally through formal roles such as mentors, team leads, shift leads. The objective of the firm is to ideally codify knowledge so that it can be transferred via the repository to the lowest (cheapest) level where it can be successfully be applied. The following sections will argue that using concepts from the practice based view of knowledge management provide a richer understanding of the factors affecting how and when solutions are documented.

A problem with documenting solutions is that while every employee is involved in analysing and closing cases only a small minority are involved in documenting solutions. An important issue regarding documenting solutions was PSE confidence. This required careful balance. PSE's with high levels of confidence in their abilities needed to have their intrinsic motivation reinforced by those reviewing their solutions who must also ensure that solutions conformed to organisational standards which may necessitate significant rework.

Much more common were employees who were not confident enough to initiate writing solutions. These PSE's are aware of the advantages to an employee's reputation of documenting solutions but were more fearful of the negative consequences of incorrectly documenting a solution. Though competent to develop a fix and close the case, their understandings of underlying meanings were sufficiently developed to be aware some solutions would only work in particular contexts. Some felt that even though they possessed the technical ability to develop and implement a fix successfully they were worried about its repercussions. They were also aware that any solution they authored would be relied upon by others who would informally be monitoring and evaluating their work. They felt that while they understood the basics of the particular knowledge domain they were worried that this might prove to be insufficient.

Another reason put forward for not documenting solutions was that it was felt to be 'someone else's job'. Some PSE's felt their job was to close cases, with the documenting

practice solely for those who are already engaged and productive in it. This category were seen by management as being ‘in a rut’, with established patterns of behaviour which it was felt were hard to change after a number of years. This was similar to the windows of opportunity outlined by (Tyre and Orlikowski, 1994).

According to (Vaast and Walsham, 2005:69) representations are “*a stable and socially shared a set of common knowledge and ideas that agents elaborate to make sense of their environment*” that provides agents with the ability to interpret events and contexts. Representation are seen by the authors as bridging the gap between sense-making, concentrating on the individual, and the structure of signification that predisposes agents to interpret events in particular ways according to their engagement with social environments. (Vaast and Walsham, 2005) use (Festinger, 1957) concept of cognitive dissonance to link actions and representations. Dissonance is the discomfort agents experience on perceiving an inconsistency between their beliefs, attitudes or actions that requires them to change the way they act and/or how they represent their environment in order to re-establish an acceptable level of consonance.

Analysis of the product support departments revealed two distinct sets of representations among PSE’s. There were those who focused on productivity and made sense of their environment by concentrating on the number of cases closed. Work for these was about meeting their cases closed metric. Within this view actions were perceived as legitimate if they served this end. Because the solution documentation practice required not just know-how but know-why it was viewed as ‘someone else’s job’ which allowed this employee type to keep a consonant image of both their job and their actions. Another class of worker saw their environment as comprising problems needing to be analysed and solved. To do this better they felt know-why as well as know-how was required because it allowed of them see complex cause and effect relationships.

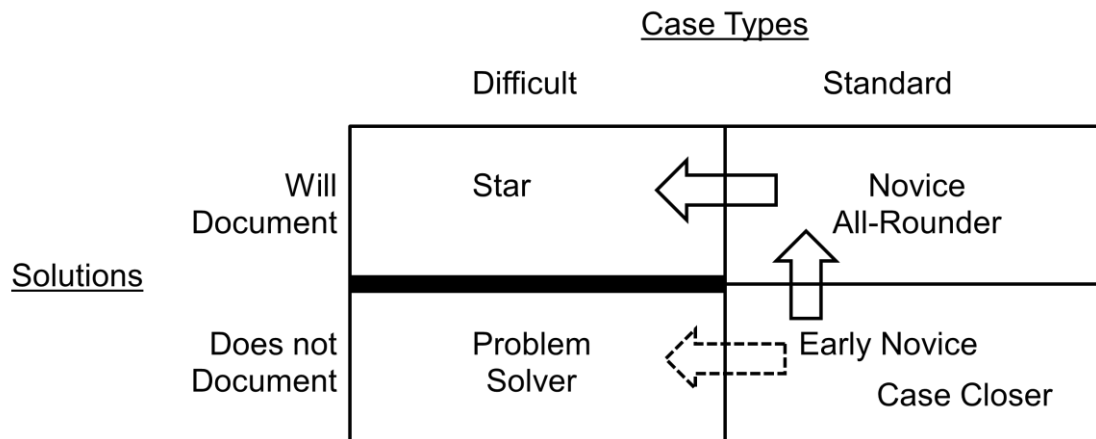
From a middle management perspective using only the case closed metric, the two representations were indistinguishable. The ability to take and solve cases was only visible at the operational management level. Their wider problem solving focus facilitated PSE’s write solutions because they were better equipped to provide a contextually valuable rationale. This representation helped determine a PSE’s willingness to engage in the

solution documentation practice as this depended on whether documenting was consonant with the employee's representation of work and identity.

In the research undertaken by (Vaast and Walsham, 2005) dissonance was felt by employees leading to a change in behaviour. In the case company middle and operational managers 'created' employee dissonance. This was used to increase the level of case difficulty. Once novices became comfortable engaging in a particular difficulty level of sense-making when analysing cases, establishing consonance, middle and operational management could draw on system features to open novices to a wider, more complex environment. This produced 'managerially created dissonance' through an act of metastructuring. Operational managers also 'float' through mentoring and coaching to support novices as they began to modify their behaviours which support dissonance resolution. Because novices are still being socialized and developing an understanding of what are legitimate activities this creation of dissonance provides a window of opportunity within which to influence a PSE's development.

The employee has to exhibit agency in considering the value of creating a solution for the group and must consider if the situation is likely to reoccur and whether the problem is time consuming to solve. They must also examine their own ability to enact the documenting practice; judging their feeling of responsibility to act in the best interests of their knowledge domain team as well as the effects on their available time and current productivity. Some employees are cautious when asked by the system if a solution is required as this action will allocate the task of documenting the solution to them. If they are not comfortable writing solutions they may choose the 'no' option as a way of avoiding this work. Where the case is likely to reoccur there can be a view that the person who next solves the case will choose document it: an abdication of responsibility for the PSE. By examining interview transcripts in relation to the meanings employees had regarding their work and the actions they found legitimate as well as their perceptions of others whom they continually monitored it was possible to identify a number of categories of worker.

Figure 44: Worker Types



1 Case Closer:

One type of employee saw their work as taking and closing cases. They were heavily focused on metrics and would ‘cherry pick’ easy cases in order to at meet if not exceed their productivity target. They believed that they concentrated on the ‘core’ work of their department and engaged in the ‘required’ task of analysing cases but did not concern themselves with documenting solutions. Such activities were not required of them as non-compliance did not bring with it any sanctions. They legitimated their work in terms of the numbers of cases they had closed and believed it legitimate not to document the solutions to problems they had analysed.

2 Problem Solver:

Another type of worker were those that were able to solve difficult cases, but avoided documenting new problems. Though novices may have built up a sufficiently trusting relationship with those mentoring them during the case analysis practice (Chapter 6) these mentors may not be themselves engaged in writing solutions. Therefore new employee may not have a relationship of trust with those in the department who were capable of mentoring than in the practice of documenting solutions.

This type of employee found meaning in their work not in terms of closing cases but rather as diagnosing and solving problems. Their primary interest was not in the number of cases closed but in discovering the solutions to the more difficult cases that were available. Due to the existing structure of domination they also resorted to cherry picking at times. This was so as to ‘make space’ to give themselves time to concentrate on lengthy cases by

creating a time buffer. They legitimated their actions based on their capacity to 'go on' in difficult situations and solve cases that had stumped their colleagues. This was in line with the organizational norm to take the Severity 1 cases first then older medium severity cases. Where this conflicted with productivity targets (a structure of domination) either a context dependent sub-practice was enacted; 'operational management mediation' or alternatively the norm against the 'cherry picking' was ignored.

Based on their knowledge of some PSE's middle and operational management came to the conclusion that certain employees were entrenched in the practices they would enact so that their representation of work and self was reified and not open to modification. They would recurrently enact this practice efficiently providing space for newer members to develop competency in the document in practice.

Similar to the work of (Vaast and Walsham, 2005) the degree of learning, gained is also dependent on the PSE's meaning around their identity and work. Some PSE's define their work in terms of closing the requisite amount of cases. This can result in cherry picking 'closable' cases. These 'metric-centric' PSE's do learn but as a by-product of the cases with which they come in contact. The type of PSE uses spaces that naturally occur and that are artificially created in their flow of work to investigate difficult cases in order to understand the reason for their listed actions. By being inquisitive in a certain area at PSE may become recognized as an expert with their reputation among the group feeding into their self identity.

3 Early Novice

For novices, in their first six to nine months, documenting solutions was not brought to their attention as an activity in which to engage because initially such employees were taking standard cases for which solutions were already available. Development was initially focused on their problem solving abilities. They were socialized into the case analysis practice by taking the 'easier' recurrent standard problems for which documented solutions existed.

However, once these analytical skills were sufficiently developed, and while they were still defining their work identity and job role (discussed in 6.7.3) managers and team leads

made a conscious effort to get these new employees to engage in the documentation practice to move them to category 4 as outlined next.

4 Novice All-Rounder

This type of employee was socialized into the case analysis practice to the extent that they were comfortable solving medium severity cases. They were concerned with problem solving but had been introduced to the documentation practice. This was done by experienced PSE's not only providing on the spot short-run help-giving during case analysis by extending this practice to include 'documentation help-giving'. This activity was presented to novices as a legitimate part of their development. This extension was supported by middle management. The software manager drew on his authority to set expectations regarding legitimate behaviours. The potential for change inherent in social reproduction, coupled with continual monitoring of others enabled new rules of legitimation to be drawn upon during help-giving interactions when it was felt the employees' frameworks were sufficiently developed. Though these rules were present and were designed to be applicable to all workers it was only drawn upon at specific times for 'ready' individuals.

5 Stars

A small core of employees (Stars) were identified who sought more difficult cases, documenting a large proportion of the new solutions to the repository. This was achieved while still managing to close the requisite number of cases. This category of worker had high technical competence in analysing and solving cases, as well as exhibiting a high willingness and competency in documenting solutions. They were ideal for socializing novice PSE's into both case analysis and case documenting practices but particular emphasis was placed on using this category for the latter practice given their relative scarcity.

Therefore even though the decision to document a case should have been straightforward it relies on the agency of PSE's. Being affected by confidence, self-perception of their own understanding, awareness of others' perceptions of their knowledge, and their personal definitions of work and responsibility, it was possible to categorise PSE's into the five types outlined above.

7.3.6 SOLUTION MODIFICATION

There are employees in each knowledge domain who review draft solutions and have the authority to change their status from draft to full Primus solutions. As part of the quality management procedure the reviewer may modify the solution themselves though more often they return it to the authors with comments on how the document should be reworked.

“when people are creating solutions it’s far too subjective... A lot of it is casual conversation, it’s meant to be a technical document but it’s not really.”

EXPERIENCED PSE

This exemplifies that strict procedures, even solutions in ‘final’ form may not meet organizationally sanctioned norms. This view led to calls for the procedure to be more routinised to reduce what was seen as the current inherent subjectivity present in solutions.

Feedback and suggestions may also be communicated to the author of the solution by e-mail where another employee has read or used their solution while analysing a case. The argument was also advanced during interviews that by emailing the author with a comment regarding a particular solution this act enabled the sender to “cover themselves” if there was an issue with the re-use of a solution and at a later date.

This reviewer and peer feedback allows PSEs to refine their documenting practices, learning what is legitimate to write and how meanings contained in the document should be expressed and how a solution should be structured. While reviewers may temper their comments so as not to demotivate the author, this had to be balanced against the necessity of providing a solution that is capable of reuse.

Problems can occur as some people and the people in the US can be less than diplomatic. A comment may read: "This solution is total garbage". When this message arrives to the original author it does not specify exactly what the problem with the solution was that caused the comment to be made and so they find it hard to accept.

KM MANAGER- INTERVIEW NOTES

7.3.7 NON-REFERENTIAL MODIFICATIONS

A more worrying modification issue was where an employee changed the text of another's solution without reference to the original author. The fix procedure was changed without an accompanying update of the rationale. An implication of this was that subsequent users experiencing problems with a solution and apportioning blame, incorrectly on the original author.

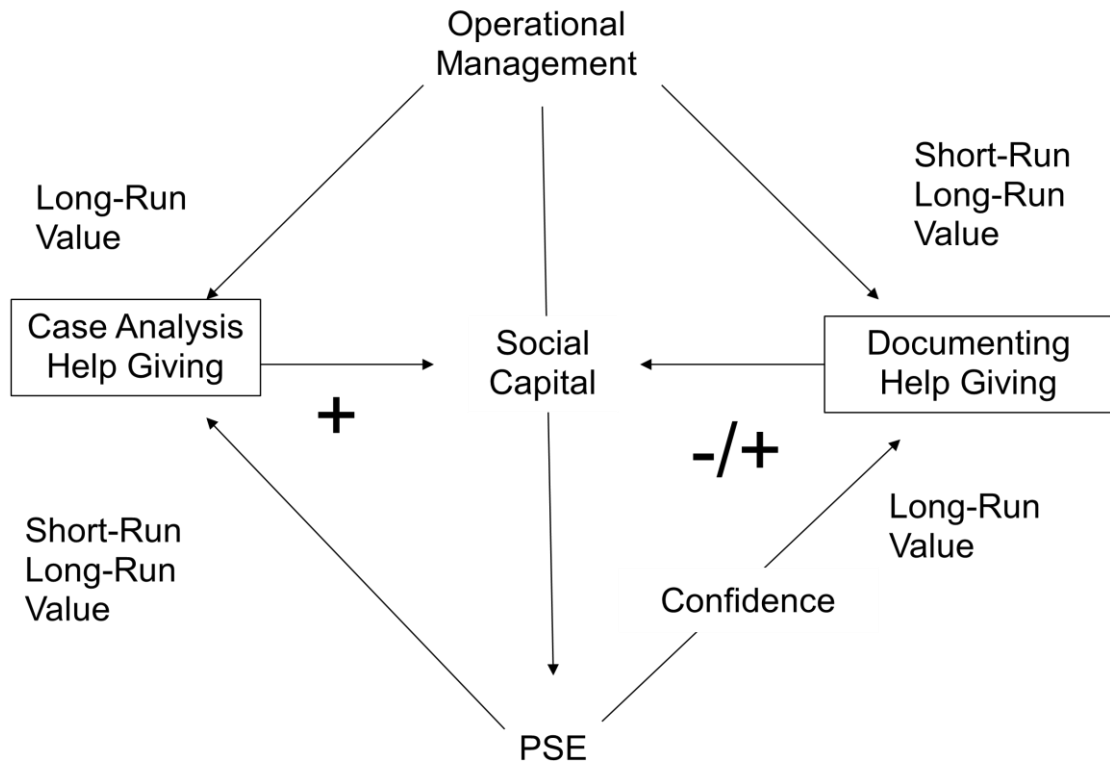
If anything is done wrong your name is shown as the original author in the solution- even though someone later may have "butchered it" afterwards.
PSE- INTERVIEW NOTES

This illustrates that even experienced employees who modified solutions may not have fully understood the solutions they have used. This is an example of employees over-reaching the bounds of their knowledgeability without immediately realizing this had occurred. It emphasizes the need for interaction in the modification process.

7.3.8 SOCIAL CAPITAL

Social relationships were built up through help-seeking and help-giving (section 6.3) and the resultant close interaction when analysing cases. This developed social capital between individual employees that was used later to develop novices' documentation practices. This is an example of where enacting one practice develops social capital that could then be expended later in developing a new practice for which no formal metric existed and where there was no sanction for non-compliance but the instantiation of which was of long-term benefit to the group.

Figure 45: Social Capital



As already outlined in sections 6.3 and 7.1 operational managers are continually directly and indirectly monitoring PSE's. It is important operational managers are knowledgeable about PSE's actions as this allows them identify when newer employees have become sufficiently proficient in the required case analysis practice that they can be introduced to the practice of documenting solutions. In the long-term the ability to document solutions among members of a knowledge domain is beneficial to the firm and to PSE's as it is a core knowledge management activity that supports the case analysis practice.

Operational management monitoring is accomplished as a by-product of the help-giving practice. From the PSE's perspective this practice provides short-run value i.e. timely help in solving problems and has long-run value in socializing them into the documenting practice through one-to-one learning. These regularized ties and interchanges due to recurrent integrated actions creating a system which allows operational managers to build up social capital with PSE's.

The help-giving practice has short and long-run value to PSE's. It is of long-term value to operational managers by developing in PSE's the competence to take more difficult cases that balance the team's workload. A negative short-run cost is the operational managers' time which could be spent closing current cases. In the case of documenting solutions help-giving is of long-run value to PSE's through increased reputation with the long-run value to the group being the increased number of employees competent to document solutions independently. Because the benefits are long-term PSE's may be reluctant to engage in this new practice. This reluctance may require operational managers to expend some of the social capital built up during the case analysis help-giving practice on reluctant PSE's. Other PSE's, taking a long-term view of their work see this documenting help giving-practice as enabling them develop valuable new competency is which will make their participation less peripheral and more core to the work of their group.

7.3.9 SPECIALIZATION

The help-giving sub-practice acted as a boundary spanning activity allowing specialist knowledge to be transferred between knowledge domains. The direct social interaction required provided access to the discursive consciousness of others and to some extent their practical consciousness through watching the specialist diagnose a problem.

The specialization of knowledge domain teams for Level 1 was replicated at higher levels. These higher levels documented their solutions and would decide if the solution needed to be written up as a technical advisory (outlined in 6.1.2), another boundary spanning object. Given the act of coding requires an underlying perspective by the coder was argued by Level 1 employees that it would be beneficial for that perspective to be codified in a format accessible at their level when it is initially being developed. When the research was conducted the solution for a problem has to be written by a Level 1 PSE after a problem occurs while a customer is waiting, rather than by the most knowledgeable person (in the Engineering department) coding the monitoring software before any problems occurred.

The Engineering department's role was circumscribed to developing and maintaining software code. However, because of structurally enforced knowledge differentials between levels of support workers additional effort was required to reformat the meanings that exist in this knowledge domain to make them amenable for reuse.

The specialization of labour by narrowing the range of cases that an employee sees, created and maintained silos of knowledge. Increased specialization through a process of complexification develops a structure of signification. Social interaction gives the original PSE access to the rules and resources drawn upon by a domain specialist as they analyse cases. The work queues feature of the case management system created a structural constraint though specialization that was overcome to a degree by as part of the case analysis help-giving practice that provided an opportunity to engage in perspective-taking.

Help-giving when documenting solutions comes from those within the knowledge domain team or the knowledge management manager. An advantage of the knowledge manager being involved is that he was able to offer specialized knowledge on enacting the documenting practice. He was able to act as a boundary spanner, identifying elements of practice that could be transferred across the product support department groups.

7.4 CONCLUSIONS- SOLUTION DOCUMENTATION PRACTICE

The conclusions for this chapter begin with sections 7.4.1 to 7.4.4 who provide repository and general management issues while the remaining sections 7.4.5 to 7.4.12 concentrate more concepts central to structuration theory and the practice-based perspective.

7.4.1 KNOWLEDGE REPOSITORY

- There was a system managed formal specialist review of draft solutions.
- There was the technical facility to flag a solved case to indicate the need for a solution to be written.

- Solutions that provided a specific set of actions to follow without a wider context limited knowledge worker learning.
- The knowledge management system increased organizational control over knowledge domains by making them more structured and providing explicit procedures and automated actions for their resolution. Increasing control over existing knowledge domains was balanced by changes in supported products that made now controllable and structured problem domains obsolete.
- The system, in supporting regulation of activities, acted to constrain agents' actions. This constraint could be accepted or, through the exercise of agency workers could create 'workarounds'.
- System features were able to cope with the micro-level detail but 'workarounds' occurred at a more macro level.
- The system supported the structure of domination but was limited in how it could achieve this, focusing as it did on the outputs of knowledge work.
- Escalated annotated cases acted as upward boundary spanning objects.
- Technical advisories served as downward spanning objects.
- Statement level security was predicated on a hierarchy that served to reinforce knowledge differentials.

7.4.2 KNOWLEDGE WORK

- Solutions had a finite usefulness. The more documented and structured a problem domain became the more amenable it was to automation.

- Solutions were versioned for different audiences even though their ultimate need was the same.
- Knowledge-workers engaged in workload and time management activities to make time available to document solutions.
- Knowledge-workers were able to develop an undesirable sub-practice. ‘Solution duplication’ was possible because middle and operational managers could monitor output quality of knowledge work but not an underlying need for the work to take place.
- Experienced to knowledge-workers could be analytically good at problem-solving but not good at documenting solutions to problems for the knowledge management repository.
- The case analysis practice could be completed with limited knowledgeability. A case could be closed by following the procedure outlined in the fix section. In some instances the case could be closed without a deep understanding of the root cause. This was not the case with the documentation practice. For the documentation practice the knowledgeability of the underlying problem domain was a necessary but not sufficient factor to categorize knowledge worker types. Employee confidence to provide a sufficiently detailed solution was also relevant.

7.4.3 ORGANISATIONAL PERSPECTIVE

- There was specialization of labour with each problem domain having the Level 1, Level 2, and Engineering domain teams: each level had increasing knowledgeability.
- The value of a knowledge management dedicated staff was that they could devote their time to activities of long-term value unlike PSE’s many of whom had a predominantly short-term focus.

- Knowledge domain teams were reinforced through a structural feature of the case management system work queue system which acted to create silos of knowledge.
- Solutions act as boundary spanning objects between knowledge domain teams within the department, across departments and between organizations.
- Help-giving spanned the boundaries that existed between knowledge domain teams due to the specialization of labour and the knowledgeability transferred via this practice.
- Solutions act to deflect low level work for knowledge workers. This involves a delegation of authority and empowerment of what was previously regarded as knowledge work to those outside the organization.
- Timing of shifts between geographic locations and consequent time differences provided knowledge workers with time to concentrate on the documenting solutions practice.
- The immediacy of the case analysis practice took time away from the important solution documentation practice making it more difficult for PSEs to remember additional useful comments to aid contextualisation.

7.4.4 MANAGEMENT

- There was a clear dialectic of control. Managers had control over how systems were configured. This enabled agents to carry out work but also constrained their range of permissible actions. The actors though to a degree constrained could use the systems in unintended ways.

- It was accepted at all organizational levels in the product support area that employees were very responsive to metrics and would strive to meet them even if this gave rise to unanticipated consequences.
- When the output of knowledge work can be recorded but a benchmark cannot be established then softer, less specific monitoring of performance is used.
- When the output of knowledge work can act as a proxy for performance more objective metrics were used.
- The managerial actions to ensure performance on case analysis and solution documentation were different. Where measures for the work to be completed were known, and where these were critical in the short-run there was constant monitoring with heavy sanctions. Where the number of solutions requiring documentation was unknown and it could not be calculated from the number of cases presenting to the department then managerial monitoring was more subtle and ad hoc than the case analysis practice.
- Managerial power was such that employees sought to meet its requirements, when both formally and informally monitored, even when they knew it was not in their long-term interests.
- The quality of the knowledge-workers efforts could only be easily, and cost effectively, assessed by operational level managers.
- A vital practice not extensively discussed in the knowledge management literature is the mediation between PSEs and middle management by operational managers (shift and team leads).
- The case closed metric was open to short-term modification through operational management mediation.

- Managers engaged in ‘expectations management’ to make knowledge-workers aware of the level they should be attaining, first in terms of knowledgeability, then in terms of the additional practices in which they should be able to engage.
- Due to PSE knowledgeability metrics concentrating on the output of knowledge work may be achieved but in ways unanticipated by management.
- Having the knowledge management manager also in charge of training on the knowledge management repository allowed relationships to be formed between him and new employees. This provided the chance for him to structure their initial definitions of their job and the organization’s view of knowledge management.
- Responsibility for short-term case analysis performance was retained by department managers while responsibility to monitor performance in documenting solutions was invested in the knowledge management manager. Thus the short-term and long-term performance measures were assigned to separate managers.

7.4.5 MONITORING OF OTHERS

- The quality of documented solutions helped to build knowledge workers’ reputations.
- Participation in the documentation practice raised knowledge-workers visibility within their department.
- Author identification in solutions enabled the identification of informal specialists and aided the help-seeking practice.
- There was informal peer review occurring as a by-product of work others used solutions to diagnose current problems.

- Monitoring extended from the self to artefacts: the solutions knowledge workers created. This ensured the subsequent integrity of solutions.
- Increased visibility had both positive and negative consequences. Unlike the analysis practice, by not engaging in the documenting practice the potential negative consequences to the knowledge worker could be minimized.
- Though documenting solutions was required by the firm in the long-run there was no explicit metric. The knowledge manager would examine the number of solutions in finished and draft form on an ad hoc basis.
- PSE actions in developing the duplication sub-practice illustrated agent's knowledgeability and monitoring of their own and others' circumstances.
- The developments of metrics were complicated by the (managerially) unintended consequences that occurred as a result of differential levels of knowledgeability regarding how knowledge work was accomplished in practice.
- More detailed and effective monitoring was achieved by operational rather than middle level managers. The acts of knowledge workers became more opaque the further managers were distanced from enacting the relevant practice.
- The nature of operational management monitoring was lessened because of how reviewing was separated from writing solutions. Content was reviewed but not the need for the solution. There was also no mechanism to identify whether a solution was required but not written up.
- Operational management monitoring of knowledge workers identified some who were not open to learning a new practice. They had become used to recursively drawing on a particular practice and were not open to change.

7.4.6 AGENCY

- Agency was exhibited when the employee decided if and how a rationale should be included in a solution.
- A decision to document a case required agency by PSEs who judged its potential benefit.
- Agency was required to decide how to reference existing solutions.
- Agency was exhibited where knowledge workers assessed the likelihood of a problem reoccurring.
- Sufficiently experienced knowledge workers had the ability to modify existing solutions. However this exercise of agency could cause them to overstretch their knowledgeability and modify the solution without adequate knowledge of the problem.
- Employees were aware of their social situation: they monitored middle and operational level managers and were aware of the limits on their knowledgeability.
- Knowledge-workers had to exercise agency to choose which among partially conflicting norms to follow. Rules may appear mutually inclusive to management but may result in one rule taking precedence over another.
- Agency was exercised to suit actors short-term rather than long-term interests
- The knowledge management manager exhibited agency by drawing on his knowledgeability of practices, even though he was no longer a 'core' member of the community that enacted them.

- Middle and operational level managers worked within a window of opportunity when developing the capabilities of novices. Metastructuring was used to avoid novices becoming ingrained in only the case analysis practice. How employees should view and define themselves was expanded when their interpretive schemes were still amenable to change at this deep level.

7.4.7 MEANINGS

- Over time, as more problem instances became available, knowledge domain teams used signifiers in increasingly precise ways to describe problems and solutions.
- The knowledge management system's 'concepts' feature enabled employees to use multiple signifiers for the same object or action.
- The knowledge management system features were ostensibly able to cope with not just homogeneous standardized search terms, exemplified by error codes, but also with the signifiers used idiosyncratically through the use of its 'concepts' feature.
- Solutions were a way of documenting part of a knowledge-workers interpretive scheme.
- Individual interpretive schemes can become structures of signification through the recurrent social interaction that occurs in the help-giving practice as well as through reading the explicit knowledge made available in solutions.
- The diffusion of employees' interpretive schemes, creating a structure of signification could be limited to defined groups through the use of the statement level security feature.
- Knowledge workers in the same department defined their work in different ways. Some limited it to diagnostic and problem-solving work while others expanded this meaning to include the practice of writing up solutions. These varying meanings

meant that workers could engage in ‘cherry picking’ but for diametrically opposed reasons.

- The hardware and software managers held different meanings around the monitoring information provided by the case management system to aid employee monitoring. The software manager was more open to operational management mediation to provide details of quality as well as quantity of cases closed.

7.4.8 PERSPECTIVES

- Writers engaged in perspective-taking to create solutions that are more comprehensible to as many audiences as possible.
- The error codes visible to Level 1 product support employees were a partial view on the Engineering department’s perspective on problems. The Engineering department defined error codes by deciding the circumstances in which they are triggered. These were the basis on which Level 1 support personnel developed perspectives.
- Product support Levels 1 and 2 make perspectives from the error codes with which they are presented. They developed meanings around the signifiers made available to them.
- Writers crafted solutions that others could use in their own sense-making activities, particularly when the latter possess less knowledgeability.
- Not only does a solution provide a set of procedures and actions it is also an artefact that reflects part of a team's perspective on a problem domain.
- The process of actively reading solutions is a form of perspective-taking relying on artefacts rather than interpersonal interaction.

- In structural terms the help-seeker has access not only to the help-givers discursive consciousness as they talk over the problem but also their practical consciousness to the extent that they can watch how the other engages in making sense of the case.
- As the underlying knowledge domain changes the artefacts that describe it also change providing a more complexified understanding.

7.4.9 NORMS

- There were no norms regarding the number of cases to be documented over any time period. The norm as that ‘necessary’ cases were to be documented.
- There was the norm that asking questions and seeking help from others was expected and encouraged. This was subject to another set of norms regarding when it was legitimate to interrupt others and that one had made an effort to diagnose the problem oneself.
- While it was legitimate to ask questions the employee was expected to learn from such encounters and not use the help-seeking practice as a substitute for developing relevant analytical skills.
- The Knowledge management repository required a critical mass of cases to be useful. Care needed to be taken in how this critical mass was achieved. The work practices that developed to cope with this new practice conflicted with established norms requiring employees to choose between rules sets.
- Existing practices can be modified by new informal managerially developed norms.
- Metastructuring was undertaken by a small group developing organizational norms around documenting solutions. Based on how the documentation practice

developed the norms were integrated into other rules-resource sets that were drawn upon as knowledge-workers carried out the rest of their tasks. This required the initial norms to be modified.

- Unanticipated consequences derived from employees placing greater emphasis on new managerially instituted norms over formerly legitimated norms about why solutions should be documented.
- The structure of legitimation enforced by department managers was changed by the punctuated break created by the metastructuring of the knowledge management manager. This allowed the department managers to more easily discard the old structures of legitimation on which they primarily relied.

7.4.10 PRACTICES

- The practice of analysing cases directly supported departmental goals in the short-term while the documentation practice was of long-term benefit.
- A distinction existed between the case analysis and solution documentation practices. The former was immediate and of core importance to the department. The latter did not require immediate action and was seen by some as the work of others.
- The case analysis practice resulted in knowledge domain teams working closely together: this limited the opportunity's to co-author documents with employees from other knowledge domains thus limiting the ability for rules regarding documenting practices to be transferred throughout product support departments.
- The documentation practice is of a long-run value by improving employee knowledgeability and value to the firm, but it incurs a short term cost.

- Solutions may be modified at the initial review stage when still in draft form, by the original author based on a reviewer's feedback. They may be modified later as a result of a subsequent reader's suggestions by either by the original author or by the reader themselves.
- Boundary spanning solutions, designed to reduce social interaction acted to increase the knowledgeability of such client-knowledge worker interactions when, due to the difficulty of work, they were necessary.
- The knowledge management manager acts as a boundary spanner for the solution documentation practice.
- Social relationships were built up through: mentoring, analysing cases together, help-seeking, co-authoring solutions and the subsequent review of those solutions.
- The help-giving practice used to support the case analysis practice was also used to develop capabilities in the documenting solutions practice.
- The PSE monitoring practice occurred in conjunction with the help-giving practice.

7.4.11 SOCIAL CAPITAL

- Work complexity and specialization of labour guarantee this development of social capital
- Social capital is build up through the practice of help-giving to improve the case analysis practice. One practice is used to develop another.
- Social capital may be either enhanced or expended when help-giving occurs in support of the documentation practice.

- If an employee's confidence is sufficiently high and their view of themselves and the work they do encompasses documenting solutions then social capital is increased as others give of their time to advance the employees own objectives. For those employees who do not possess confidence about writing solutions and who do not see this as a core part of their job social capital, built up in helping them with the case analysis practice, is expanded to get them to develop in the documentation practice.

7.4.12 CHANGE

- The knowledgeability required by employees was increasing over time.
- Easier standard cases were becoming less common due to problem deflection and automation.
- Continuous change meant that the perspective on a problem domain reflected current understanding and meanings and always needed to be seen as open to modification.
- The pace of change was such that PSE's retained power and avoided deskilling not because they routinely following the detailed procedures documented in solutions but through the exercise of agency in analysing novel cases and creating and updating solutions.

8 LIMITATIONS, CONCLUSIONS, AREAS FOR FUTURE RESEARCH AND RESEARCH CONTRIBUTION

The concluding chapter of this thesis considers four areas. Firstly, it outlines six limitations of the research study. Secondly, it provides overall conclusions relevant to three different categories of user as well as to knowledge repository developers. The third section indicates the research contributions for the literature dealing with; structuration theory and the practice-based perspective; the broader knowledge management literature; and finally research into call centres. The chapter and thesis finish by outlining areas for future research.

8.1 LIMITATIONS

8.1.1 THEORETICAL PERSPECTIVES

The research is limited by the theoretical perspective adopted by the researcher. As a new field of study researchers from different areas are bringing a myriad of theories to the literature on knowledge management. Traditionally these perspectives have viewed knowledge as an object. Given the emphasis the product support departments placed on creating and leveraging knowledge assets in the form of Primus solutions theories from the knowledge-as-object view would seem a logical choice to use for analysis. By choosing the practice-based view, heavily influenced by structuration theory, the focus of interest for the study was limited by the sensitising concepts on which this perspective is based. Rather than concentrate on how knowledge is represented or the technicalities of how it is shared what was of interest was an understanding of how people accomplish knowledge work. The theoretical concepts used emphasised the social aspects of how work was carried out as well as the accompanying managerial and organizational issues.

8.1.2 CASE CONTEXT

A cursory glance at the Level 1 product support departments may have suggested that the work was not particularly knowledgeable but rather routine and overly structured for the type of study chosen. However pilot interviews convinced the researcher that while the majority of cases were of a routine and procedure nature there was a minority of problems that did require knowledgeability and met the case study company selection criteria.

The study is bounded by the case study context in terms of the people interviewed, the industry, and work involved as well as the degree to which the company has developed knowledge management initiatives. The nature of the work investigated meant that employees could observe, through information systems, their reality and the effects their knowledge work had on clients systems. Because the content of some solutions was difficult to comprehend, even for those in the same department, it is not surprising that the detail of some solutions were only understood in basic terms by the researcher. However, because the focus was on practices relating to how problems were analysed and documented, and the implications of this for knowledge management, it was felt that the researcher's general understanding, having lectured in the area for eight years, was sufficient. Someone with a more detailed understanding of the context contained in the documented solutions would, no doubt, have provided a more detailed analysis of this part of the research.

A few years earlier the company had implemented a knowledge management repository. Practices around how the system was used had just become reified and therefore the research represents an understanding of the system at a particular point in time. These factors provided context for the research and the case study.

8.1.3 ACCESS TO COMPANY

Access to the company was initially through the hardware department manager. No formal access agreement was drafted and the pilot interviews were used to determine if the company met the requirements for a case study company and also the access to staff would be acceptable to both researcher and company. Interviews with PSE's (knowledge-

workers) could only take place after the company's product support apartment in the United States had come on-line in the afternoon. This limited the amount of available time each day and available for interviews. Advantage was taken by the researcher of a glass panels in meeting room off the main support centre used for interviews to also conduct some observations of the knowledge-workers as well as having informal discussions with managers and team-leads over coffees and lunches.

Access to interviewees was arranged by the team leads in each department based on employee availability. Their choice was based on the researchers request for PSE's with various levels of experience and from different teams within the department.

Access to the knowledge management system was also limited. A number of employees talked the researcher through examples of taking cases and using the knowledge management repository but he was not given access to watch employees using system live. This was not of particular concern as the speed at which they worked would make it difficult to comprehend their actions. Examples of system usage were discussed at length during recorded interviews, allowing the researcher to subsequently read and re-read transcripts of these descriptions. In addition documentation was available on the systems both internal to Pi-Corp and also accessed from the web site of the third party knowledge management system vendor. The time available to view and read solutions was limited when on-site at the case company. However the researcher was given access to the website used by customers to access primus solutions.

8.1.4 RESEARCHER RELATED

The interview questions and subsequent analysis are limited by the researcher's comprehension. Designing the interview questions to gain an understanding of the situation was helped by pilot interviews. As new issues were raised in interviews tape daily recordings were replayed by the researcher each evening to decide where further probing questions were needed and to determine if theoretical saturation had been reached. Where some items were not immediately clear the tape could be replayed to improve comprehension. In addition discussions with the knowledge management manager helped clarify procedural and factual issues. As already outlined comprehension of technical

details was not as necessary as comprehension of the social and organizational aspects of the work was the objective.

8.1.5 RESEARCH METHODS

The research is limited as it involved a single, rather than multiple, case study. Though this limits the generalisability of the findings it had the advantage of keeping the context in which the work was carried out constant as well as easing the time constraints imposed on the researcher. As will be argued next the objective is not to achieve statistical but rather an analytical generalisability so that the use of multiple cases were not a *sine qua non*.

Interviews were the principle of data collection method. The objective of the research was to study the practices engaged in by knowledge-workers. Reliance was on employees descriptions of what they did rather than the researcher being able to engage in the practice as a participant in action. Because of the level of access accorded the researcher it was only possible to engage in very limited participant observation. The reliability of the views expressed in interviews was reinforced where several employees reiterated the same point. Interviews sought to access the interpretations of employees with different levels of experience as well as a managerial viewpoint. Solutions, as the output of the relevant practices were also examined in light of the views expressed.

Though of immense value to the researcher the tape recording of interviews may have inhibited interviewees. This danger was lessened by an initial guarantee of anonymity at the beginning of each interview as well as seeking permission to record the interview. No one asked for their comments not to be recorded and interviewees were found to be open and willing to discuss their work. One reason for this may be that every keystroke by employees was recorded and may be examined if employees made a serious mistake. On a few occasions when the subject seemed reluctant on certain points the researcher turned off the recording device and continued the discussion, making notes after the interviews concluded.

8.1.6 GENERALIZABILITY OF FINDINGS

Because an interpretive rather than positivist methodology was employed statistical generalisability was not possible and this may be considered a limitation. However the goal was analytic rather than statistical generalization. Because the objective was analytic generalization interviews were conducted not until a specific number was achieved but until theoretical saturation was reached. Analysis was aided by coding in the NVivo qualitative research software package used to bring actors perspectives on an issue together, aiding analysis. The use of software also improved the reliability of the study by providing a case database that could be accessed by another researcher.

Interpretive evaluation criteria were used. This involves considering rival explanations by comparing respondents descriptions of issues with others at different levels of experience hierarchy and apartment. Also negative evidence for rival explanations was sought. The analysis is limited by the strength of the explanations provided which should be logically consistent and show an understanding of the actors' rationales.

8.2 CONTRIBUTIONS TO STAKEHOLDERS

The main conclusions are presented in the next sections as they apply to the various stakeholder groups.

8.2.1 KNOWLEDGE WORKERS

There is a need to balance at the individual level the exploration and development of new knowledge with the exploitation of current knowledge.

Knowledge workers need to consider how they see their long-term career in the organization and then consider the necessary actions, some of which may be a long-term, to achieve these career objectives.

Knowledge-workers should not only develop specialisms in areas of intrinsic interest but also seek out areas needed by their group or department. Given the categorisation of

knowledge into domains it is possible to conduct in knowledge domain gap analysis at level of an individual or team.

Even new employees, by exploring emerging knowledge areas, may build specialisms in a narrow field.

They should see documents not only as an output of and input into case analysis but also as artefacts through which they represent themselves to their department and clients. The documents they have authored project an image of themselves.

They should be careful not to reuse knowledge uncritically without reflection. They need to consider the context in which this knowledge was originally applicable and compare this with the context in which they plan to use it.

They need to maintain an awareness of the provisional nature of the meanings and relevance of documented knowledge.

They should only restrict access to sections of a solution where the reason for doing so is to protect the firm's reputation rather than in an attempt to afford knowledge as a mechanism for retaining organizational power.

Considering the aspects of their work requires most knowledgeability and are of most value to the organization brings with it a realization that the inherent value of knowledge workers is based on their ability to make sense of clients problems and to document the solutions developed in a way that does not require the same problem to be solved twice. Another key aspect of their knowledgeability is to know whether meanings contained in existing solutions are still relevant to current problems.

It is important that knowledge-workers appreciate the wider implications of their work. They need to define and redefined the boundaries at which the applicability of their work 'shades off'. It is also useful for them to see how a new solution fits into the established perspective on a problem domain.

It is valuable if knowledge-workers can see the implication of their work on others, both internally and externally. Gaining an understanding of the perspectives of others better equips them to write solutions for wider audiences. This understanding can be gained during interactions with others as a by-product of their day-to-day practices, but it is useful if knowledge-workers are aware of this potential by-product.

Knowledge-workers should seek to balance an appreciation for hard and soft monitoring. It is tempting to behave in a way that is congruent with the immediacy of hard metrics. Consideration should also be given to softer, informal and more subtle monitoring in other areas of performance.

Knowledge-workers need to identify how they bring value to the firm and base their actions on these. Some knowledge workers focused on actions which they performed well and when needed by the organization operationally but did not develop strategic capabilities within the department.

Even in environments where knowledge-workers can get immediate feedback and observe the results of their work it is still possible for them not to understand the full implications of what they have done. They need to be careful not to overextend the bounds of their knowledgeability.

In documenting their work a balance in needs to be struck between a fear of future misuse and hubris about the value and applicability of their solution. They need appropriate organizational procedures to provide psychological security for the individual and security of a reputation for the organization.

While it is important to concentrate on the core actions and practices of their work it is also useful to be aware and take advantage of the opportunities that present themselves as by-products of accomplishing knowledge work that are useful in the long run. Examples included learning about the wider problem domain in which a problem resided and developing more advanced analytical practices by engaging in question and answer sessions and watching more experienced employees.

Knowledge-workers need to be careful what activities they use to define themselves and their work and what are seen as core actions.

There is a danger that knowledge workers could deskill themselves by using information systems designed to aid knowledge management. The system features examined allowed knowledge workers to select cases for which a predefined set of actions could be used requiring no reflexivity.

8.2.2 OPERATIONAL MANAGERS

This lowest level of managers which included shift-leads and team-leads need to keep abreast of how their knowledge domain is developing. They need to ensure solutions are created for new recurrent problems. It is important that they ensure that documented solutions in draft form are reviewed by experienced team members and made available as quickly as possible as finished solutions.

By coordinating with the sales department they can forecast the areas in which knowledge needs to be developed in the medium term and can allocate this task to particular employees. This provides knowledgeable individuals in an area before new problems begin to arise and can also be used as a developmental activity.

It is important that they understand the important role they play as boundary spanners between middle managers and knowledge-workers. In this role they mediate the needs and expectations of both parties and partially share perspectives and understandings of what are legitimate work norms with both sets of actors.

Operational managers being intimately involved in analysing and documenting cases with knowledge-workers have the ability to augment middle managers use of system derived metrics and expand their understanding of knowledge work practices as they are in a position to provide detailed knowledge of the difficulty and quality of work undertaken by knowledge workers.

They should see monitoring knowledge workers as both beneficial to the organization and also to the development of the knowledge-workers in their team. Through their actions they can help to align the goals of both these parties.

They can act to develop knowledge-workers by ensuring their team members are aware of the long-term rationales for the actions they are expected to take, particularly those with a long-term emphasis. Thus not only can operational management monitoring be seen as a control mechanism but also as a developmental opportunity.

It is vital to ensure that operational managers retain their level of expertise in the knowledge domain in order to help and monitor team members as the ability to enact the case analysis practice aids the monitoring practice.

8.2.3 MIDDLE MANAGERS

The middle managers in charge of the two departments examined understand that if they are not involved in the detailed practice of the knowledge work they cannot fully understand its intricacies. Therefore some of the actions taken by knowledge-workers to enact this practice are opaque to them.

They need to be open to the advice and opinions of operational managers and use these to augment the information available from information systems in monitoring the members of their department.

A balance needs to be struck between the use of quantitative and qualitative measures of performance derived from the knowledge management system and operational managers respectively. Where this balance lies depends well on the visibility of the knowledge work practices and middle managers comprehension of the detail of knowledge work performed.

Their actions and can be improved where they seek the views of knowledge-workers regarding how practices should be changed in order to reduce the risk of unintended consequences of the latter's actions which can be unforeseen by other levels.

They should be open to examining the rationales underlying apparently negative actions by knowledge-workers in order to determine if the actions taken have a positive benefit for the firm.

It is also important that middle managers realize the effects metrics imposed on one knowledge work practice have on others. By stressing metrics in one area to achieve beneficial outcomes an unintended consequence may be negative behaviours in another practice as knowledge workers seek to align their actions with new norms and meanings.

They need to communicate organizational expectations around work, particularly regarding practices that cannot be completely monitored.

8.2.4 TOP MANAGERS/ORGANIZATIONAL PERSPECTIVE

Segmenting knowledge into organizationally hierarchical levels provides economic benefits through the specialization of labour. This can limit knowledge transfer where higher levels in the organization do not make their knowledge available to lower levels. It is important to consider what organizational mechanisms can be put in place to ensure the vertical knowledge sharing among levels of product support.

8.2.5 KNOWLEDGE MANAGEMENT SYSTEM DEVELOPERS

A balance must be struck between the need for solutions in the knowledge management repository to be modified in line with changes to the underlying problem domain while also requiring the system to reflect quality management procedures to ensure the integrity of modifications.

The categorization scheme offered by the organizational taxonomy can help structure the meanings in the knowledge base drawn upon by employees as this can act to enable the integration of information between separate information systems.

The more meanings around problems and contexts are defined the easier it is to remove solutions from the repository because they had been made obsolete through using information systems automate removal of the underlying cause.

Access rights to solutions require matching the knowledgeableability of the user with the right to read or modify documents in the knowledge management system.

Some understanding of the recursive practices underlying knowledge work enabled system developers identify well defined, structured and time consuming activities which could be automated. This activity served to change the nature of the underlying work. Where changes is present in the underlying work practices then this activity can serve to increase the value of the, perhaps remaining, knowledge-workers by removing standardised activities and increasing the amount of work requiring knowledgeableability to be exercised.

8.3 CONTRIBUTIONS

8.3.1 STRUCTURATION THEORY/PRACTICE BASED PERSPECTIVE

This research helps extend the structurational perspective. It provides additional empirical examples of interpretive schemes, norms and resources as they are used in everyday knowledge work. It uses these modalities of structuration to help explain recurrent practices: in doing so it moves goes beyond much of the traditional application of structuration theory to information systems- using it not as a meta-level theory but rather at a more micro-level.

In particular it shows how a (case analysis) practice can help develop and maintain a structure of signification through the recursive action of knowledgeable agents. The research also considers the concept of agency within what is seen in the call centre literature as a very structured environment with little room for employee agency. This is particularly relevant given the call for structurational research studies in such a research context by (Jones and Karsten, 2008).

The current research helps develop empirical studies in the newer area of knowledge management research- the practice based view. This is a new perspective and requires much empirical work, in different organisational environments to help it develop and advance. The case study presented in this thesis outlines in detail the practices and sub-practices used for a particular type of company: a highly structured product support centre with employees engaged in knowledge intensive work regarding technical problems in the areas of hardware and software.

In doing so it found that the practice-based perspective provided additional and deeper understandings regarding how knowledge management was undertaken than provided by the knowledge-as-object perspective. In the case company studied it could be argued that the knowledge-as-object view suitable. The knowledge assets were the solutions held in a repository. There were detailed procedures that outlined how cases were to be analysed and solutions documented. Though a logical choice, it is not all encompassing and the understanding of the practices involved in analysing cases and documenting solutions made available via the practice-based perspective augments understanding.

While knowledge assets may exist and be owned by the organisation this is not sufficient. Even where solutions were available their use required additional practices to develop and use these assets. The research found that not all workers followed the same set of actions: there was some indeterminacy of practice. Employees existing interpretive schemes had an effect on the actions they undertook. Understanding how such practices were enacted and, where there is indeterminacy, why certain courses of action are taken is important. Because these practices provide a core capability for the firm management of knowledge workers is also improved by a better understanding of what they actually do in practice rather than a description of what they are supposed to do contained in organisational documentation.

The traditional literature on knowledge management focuses on categories of knowledge and knowledge management processes that seek to codify and share knowledge assets via information technology. There is an underlying assumption that the language used in knowledge assets should be objective and precise. This study found that while, for standard cases this was true, in more demanding cases knowing when, and when not to use these assets was important. The ability to document these circumstances depended on the

knowledgability of the worker. While the literature on knowledge management outlines the benefits to workers of producing knowledge assets it does not consider how a refusal to document can be related to factors such as confidence and worries about reputation by overstressing ones knowledgability.

Agents' interpretive schemes hold a common stock of knowledge regarding problems. Actors' interpretive schemes were shared across the whole group. Some meanings are idiosyncratic to a group due to the specialization of labour. The impetus for change is derived from new products being released. These create new problems and contexts to which current interpretive schemes must be applied. The structure of signification is the perspective that the departments have developed through enacting Sense-Making activities on problems. Due to the specialization of labour new interpretive schemes are created within knowledge-domain teams. New meanings were created by an individual or small number of individuals and shared through the use of boundary spanning solutions.

The existing organizational taxonomy acts to both enable by providing existing meanings and linking them to error codes but may act as a constraint in the classification of new meanings. The taxonomy is drawn upon by workers and so acts to structure their interpretive schemes.

Actors' draw on primus solutions and their own interpretive schemes during the practice of analysing a current problem. Both may change as a result. This change of interpretive scheme becomes a change to the structure of signification when through the repository is augmented and subsequently diffused the department.

Structures of signification must be shared. To qualify as such the individual changes to interpretive schemes need not be directly passed on to others through interaction in a common practice but can be transferred using the solution artefact. This is possible where the writer and reader have similar interpretive schemes. The solution artefact can be augmented for 'less similar' interpretive schemes. It requires the actors to be able to engage in the practice of perspective-taking. Though typically working alone social interaction among knowledge-workers is important to diffuse the practices of analysing and documenting cases.

Communicative genres were important to knowledge management as they were drawn upon in sense-making practices and we're used to document emerging perspectives on knowledge-work, and to augment actors own interpretive schemes.

The more defined and stable a perspective on a knowledge domain becomes the less importance it has for knowledge-workers becoming more amenable to automation.

The research also details several instances where agency is exhibited reinforcing the importance of the knowledgeability of the actor even in a work environment that is highly structured, standardized and procedural

The nature of change, by providing new context specific problems to which existing knowledge must be extended and created, places the agency of actors central to knowledge-work.

System features reinforce a differential access to documents through which the learning can occur. Thus differentials in agency are reinforced in complex cases. However for current and standard cases access to documentation is widened so as to increase learning among clients and increase the efficiency of the department.

Because the underlying 'knowledge-assets' with which the PSE's work is constantly changing what is critical is their knowledgeability: their ability to modify existing knowledge and create new knowledge to complete context specific work.

Though the problems PSE's are asked to solve are recurrent this is constrained numerically and temporally.

As particular cases reoccur it becomes clear that its root cause requires resolution. Alternatively cases that derive from new product releases occur over a life cycle, from clients who are early adopters to laggards in a predictable manner; they are removed by subsequent patches and upgrades.

Work norms were identified at the department, organization, and inter-organisational levels.

Organisational work norms centred on: levels of service, sequence of case selection, case reuse, workers remaining with the case, actions being recorded, solution identifiers being included in cases, and an automation of structured problem domains.

Departmental work norms included workers cherry picking cases, balancing case workloads, help-seeking and help-giving, solution identifiers being included in cases in certain circumstances, the reuse of solutions where possible. Inter-organizational work norms involved external clients attempting to redefine the case boundary as well as access to existing solutions, or parts of solutions.

8.3.2 KNOWLEDGE MANAGEMENT

The study provides an empirical case study outlining how a knowledge management system was used. Pi-Corp was examined from a knowledge-as-object and knowledge as practice perspective. The study shows how the knowledge-as-practice perspective adds additional insights and understanding to the more traditional knowledge-as-object view.

Knowledge management tends to focus on industries and work that is more creative in nature where knowledge management is more ambiguous this case examines concepts in what is apparently a standardized and predictable environment. The case shows how the practice-based view is valuable even where knowledge can be considered ‘justified true belief’ as well as where meanings are more open to interpretation.

It examined core knowledge management practices firstly problem-solving involving the application of knowledgability in situations and secondly documenting cases for a knowledge repository.

It provides a description of knowledge work showing how even in tasks with a high repetitive nature there are elements of knowledge intensity. It considers how even in individualized work contexts individuals require social interactions for the completion of that work.

It outlines the conditions when information systems are, and are not, needed by knowledge-workers.

It outlines the portfolio of sources of knowledge used to accomplish knowledge work.

Even environments where knowledge can be empirically justified alternative meanings and norms can exist. The case study examines the factors to consider when knowledge objects in structured and well defined environments are being written where the objects reflect not a complete underlying reality but one that is constantly developing.

8.3.3 CALL CENTRES

This study helps extend the literature on call centre because even though the technologies, organizational objectives and the governance mechanisms outlined in the literature are similar to the case company in some respects as the research involved an atypical example where: more complex work requiring higher levels of skills and qualifications than in traditional call centres with technical skills regarded as more important than personality traits; the departments focus was entirely on the high end the business market; it served a global rather than regional or national market; employees were not focused on taking calls over the phone with some of the work, due to information and communications technology, not even requiring the customers awareness that a problem existed.

8.4 AREAS FOR FUTURE RESEARCH

Because the research was conducted using a single case study of a particular company it would be useful to carry out additional case studies in the following areas:

- Replication of the study in similar hardware and software call centres would help determine the degree of standardisation and variation in the practices described in this research.

- By using more traditional call centres where work is more structured and scripted differences in practices based on the knowledge intensity of work within an industry could be explored.
- The current research used a relatively structured work environment. It would be useful if more unstructured environments were investigated, in different industries. Particularly where the results of knowledge work is initially ambiguous and cannot be immediately validated.
- Changes in the underlying knowledge base required for work in Pi-Corp was continuous and incremental. An examination of environments where changes was more discontinuous and radical would be revealing.

This research looked at a company that was already using a knowledge management system.

- A subsequent analysis of companies in the process of planning to introduce, and the resultant implementation, of a knowledge management system would provide an opportunity to see how relevant meanings, norms and resources were developed and modified in this initial implementation period.
- Subsequent analysis could usefully focus on internally developed knowledge management systems rather than those purchased from an external vendor.

- Of particular interest at the moment would be companies that are using configurations of web 2.0 and 3.0 technologies to support their knowledge management activities.

Ideas and issues raised in the research which could bear future research include:

- A focus on the relationship between knowledge workers and their first line supervisors/team leads.
- The use of formal and informal metrics to supervise knowledge work processes as well as outputs.
- Knowledge workers sense of identity and virtual self-representation in both the short and long terms.
- An analysis and classification of types of solution produced by the software support departments i.e. the output of knowledge work practices.

9 BIBLIOGRAPHY

- ABUALSAMH, R. A., CARLIN, B. & MCDANIEL, R. R. 1990. Problem structuring heuristics in strategic decision making. *Organizational Behaviour and Human Decision Processes*, 45, 159-174.
- ACKOFF, R. L. 1974. *Re-designing the Future*, New York, Wiley
- ADRIA, M. & CHOUDRY, S. D. 2002. Making Room for the Call Centre. *Information Systems Management*, 71-80.
- ALAVI, M. & LEIDNER, D. E. 2001. Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25, 107-136.
- ALLEN, J., JAMES, A. D. & GAMLEN, P. 2007. Formal versus informal knowledge networks in R&D: a case study using social network analysis. *R&D Management*, 37.
- ALLEN, T. J. & KATZ, R. 1986. The Dual Ladder: Motivational Solution of Managerial Delusion. *R&D Management*, 16, 185-197.
- ALLEN, T. J. & KATZ, R. 1995. The Project Orientated Engineer: A Dilemma for Human Resource Management. *R&D Management*, 25, 129-140.
- ALVESSON, M. 2000. Social Identity and the Problem of Loyalty in Knowledge-Intensive Companies. *Journal of Management Studies*, 37, 1101-1123.
- ANGUS, J., PATEL, J. & HARTY, J. 1998. Knowledge Management: Great Concept...But What Is It? *Information Week*.
- ARCHER, M. 1990. Human Agency and Social Structure. In: CLARK, J. C., CELIA, M. & SOHAN, M. (eds.) *Anthony Giddens: Consensus and Controversary*. London: The Falmer Press.
- ARDLEY, B. 2006. Telling Stories about Strategies: A Narratological Approach to Marketing Planning. *The Marketing Review*, 6, 197-209.
- BAIN, P. & TAYLOR, P. 2000. Entrapped by the 'electronic panopticon'? worker resistance in the call centre. *New Technology, Work and Employment*, 15, 2-18.
- BAIN, P., WATSON, A., MULVEY, G., TAYLOR, P. & GALL, G. 2002. Taylorsim, targets and the pursuit of quantity and quality by call centre management. *New Technology, Work and Employment*, 17, 170-185.
- BAKKER, A. B., DEMEROUTI, E. & SCHAUFELI, W. B. 2003. Dual processes at work in a call centre: An application of the job demands- resources model. *European Journal of Work and Organizational Psychology*, 12, 393-417.
- BARLEY, S. C. 1986. Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments. *Administrative Science Quarterly*, 31, 78-108.
- BARTHES, J.-P. A. & TACLA, C. A. 2002. Agent-supported portals and knowledge management in complex R&D projects. *Computers in Industry*, 48, 3-16.
- BELANGER, F. & WATSON-MANHEIM, M. B. 2003. Communication mode repertoires: An extension to media choice theories. *Under Review*.
- BELT, V., RICHARDSON, R. & WEBSTER, J. 2002. Women, social skill and interactive service work in telephone call centres. *New Technology, Work and Employment*, 17, 20-34.
- BELT, V., RICHARDSON, R., WEBSTER, J., TIJDENS, K. & VANKLAVEREN, M. 1999. Work opportunities for women in the information society: call centre teleworking. Brussels: Information Society Project Office, (DGIII, DGXIII), European Commission.

- BENBASAT, I., GOLDSTEIN, D. K. & MEAD, M. 1987. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*, 11, 369-386.
- BENBASAT, I. & ZMUD, R. 1999. Empirical Research in Information Systems: The Practice of Relevance. *MIS Quarterly*, 23, 3-16.
- BERGER, P. & LUCKMAN, T. 1966. *The Social Construction of Reality*, London, Penguin Books.
- BLACKLER, F., REED, M. & WHITAKER, A. 1993a. Editorial Introduction: Knowledge Workers and Contemporary Organizations. *Journal of Management Studies*, 30, 851-862.
- BLACKLER, F., REED, M. & WHITAKER, A. 1993b. Epilogue: An Agenda for Research. *Journal of Management Studies*, 30, 851:862.
- BLOOR, G. & DAWSON, P. 1994. Understanding Professional Culture in Organizational Context. *Organization Studies*, 15, 275-295.
- BLUEDORN, A. C. 2002. *The human organization of time: Temporal realities and experience*, Palo Alto CA, Stanford University Press.
- BOISOT, M. & COX, B. 1999. The I-Space: a framework for analyzing the evolution of social computing. *Technovation*, 19, 525-536.
- BOISOT, M. H. 1998. *Knowledge Assets: Securing Competitive Advantage in the Information Economy*, New York, Oxford University Press.
- BOLAND, R. J. 1996. Why Shared Meanings Have No Place in Structuration Theory: A Reply to Scapens and Macintosh. *Accounting, Organizations and Society*, 21, 691-697.
- BOLAND, R. J. & TENKASI, R. V. 1995. Perspective Making and Perspective Taking in Communities of Knowing. *Organization Science*, 6, 350-372.
- BORG, K. 1999. The "Chauffeur Problem" in the Early Auto Era: Structuration Theory and the Users of Technology. *Technology and Culture*, 40, 797-832.
- BORGATTI, S. P. & CROSS, R. 2003. A Relational View of Information Seeking and Learning in Social Networks. *Management Science*, 49, 432-445.
- BOURDIEU, P. 1977. *Outline of a theory of Practice*, Cambridge, Cambridge University Press.
- BRANNAN, M. J. 2005. Once More With Feeling: Ethnographic Reflections on the Mediation of Tension in a Small Team of Call Centre Workers. *Gender, Work and Organization*, 12, 420-439.
- BREU, K. & PEPPARD, J. Year. The Participatory Paradigm for Applied Information Systems Research. In: The 9th European Conference on Information Systems, 2001 Bled, Slovenia. 243-252.
- BROOKE, C. 2002. Information systems at CallCentre. *International Journal of Information Management*, 22, 389-401.
- BROWN, J. S. & DUGUID, P. 1991. Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning and Innovating. *Organization Science*, 2, 40-57.
- BROWN, J. S. & DUGUID, P. 2001. Knowledge and Organization: A Social-Practice Perspective. *Organization Science*, 12, 198-213.
- BRUNER, J. S. 1986. *Actual Minds, Possible Worlds*, Cambridge MA, Harvard University Press.
- BUKOWITZ, W. & WILLIAMS, R. 2000. *The knowledge management fieldbook*, London, Prentice Hall.
- BURRELL, G. & MORGAN, G. 1979. *Sociological Paradigms and Organisational Analysis*, London, Heineman.

- CALLAGHAN, G. & THOMPSON, P. 2002. 'We Recruit Attitude': The Selection and Shaping of Routine Call Centre Labour. *Journal of Management Studies*, 39, 233-254.
- CARAYANNIS, E. G. 1999. Fostering synergies between information technology and managerial and organizational cognition: the role of knowledge management. *Technovation*, 19, 219-231.
- CARTWRIGHT, T. J. 1973. Problems, solutions and strategies: a contribution to the theory and practice of planning. *AIP Journal*, 39, 179-187.
- CAVAYE, A. L. M. 1996. Case study research: a multi-faceted research approach for IS. *Information Systems Journal*, 6, 227-242.
- CHARLES, D. 2006. Universities as Key Knowledge Infrastructures in Regional Innovation Systems. *Innovation*, 19, 117-130.
- CHEUNG, W. M. 2006. Ontological Approach of Organisational Knowledge to Support Collaborative Product Development. *Journal of Advanced Manufacturing Systems*, 5, 3-25.
- CHINOWSKI, P. & CARRILLO, P. 2007. Knowledge Management to Learning Organization Connection. *Journal of Management In Engineering*, 23, 122-130.
- CHO, H., LEE, J.-S. & STEFANONE, M. G. Gay. Development of computer-supported collaborative social networks in a distributed learning community. *Behaviour & Information Technology*, 24, 435-447.
- CHO, H., LEE, J.-S., STEFANONE, M. & GAY, G. 2004. Development of computer-supported collaborative social networks in a distributed learning community. *Behaviour & Information Technology*, 24, 435-447.
- CHRISTIANSEN, C. R. 2006. Sense-Making and Entrepreneurial Coalition Building: A Case of Competing Interests, Cultural Barriers, and Interorganizational Relations in a Nonprofit Health Plan. *International Journal of Public Administration*, 29, 501-515.
- COFFEY, A. & ATKINSON, P. 1996. *Making Sense of Qualitative Data*, London, Sage Publications.
- CONSTANT, D., KIESLER, S. & SPROULL, L. 1994. What's mine is ours, or is it? A study of attitudes about information sharing. *Information Systems Research*, 5, 400-422.
- COOK, S. D. N. & BROWN, J. S. 1998. Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. *Organization Science*.
- COOK, S. D. N. & BROWN, J. S. 1999. Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. *Organization Science*.
- COOPLEY, J., KEEGAN, O. & EMLER, N. 1997. Managers' Innovations as 'Sense-making'. *British Journal of Management*, 8, 301-315.
- CRAMER, J., HEIJDEN, A. V. D. & JONKER, J. 2006. Corporate social responsibility: making sense through thinking and action. *Business Ethics: A European Review*, 15, 380-389.
- CROWSTON, K., SAWYER, S. & WIGAND, R. 2001. Investigating the interplay between structure and information and communication technology in the real estate industry. *Information Technology & People*, 14, 163-183.
- CROWSTON, K. & WILLIAMS, M. 2000. Reproduced and Emergent Genres of Communication on the World Wide Web. *The Information Society*, 26, 201-215.
- DAAR, A. 2003. Control and autonomy among knowledge workers in sales: an employee perspective. *Employee Relations*, 25, 31-41.

- DALAL, N. J., SINGH, S. N. & LANIS, T. 1999. Research concerns of Information Systems Faculty: An Exploratory Investigation. *Journal of Computer Information Systems*, 18-28.
- DALKIR, K. 2005. *Knowledge Management in Theory and Practice*, London, Elsevier Butterworth Heinemann.
- DARKE, P., SHANKS, G. & BROADBENT, M. 1998. Successfully completing case study research: combining rigour, relevance and pragmatism. *Information systems Journal*, 8, 257-272.
- DAVENPORT, T. 1997. *Information Ecology: Mastering the Information & Knowledge Environment*, Oxford, Oxford University Press.
- DAVENPORT, T. H., JAVANPAA, S. L. & BEERS, M. C. 1996. Improving Knowledge Work Processes. *Sloan Management Review*, 53-65.
- DAVENPORT, T. H. & PRUSAK, L. 1998. *Working Knowledge: How Organizations Manage What they Know*, Boston MA, Harvard Business School Press.
- DEERY, S., IVERSON, R. & WALSH, J. 2002. Work relationships in telephone call centres: understanding emotional exhaustion and employee withdrawal. *Journal of Management Studies*, 39, 471-496.
- DEMAREST, M. 1997. Understanding Knowledge Management. *Long Range Planning*, 30, 374-384.
- DEPRES, C. & CHAUVEL, D. 1999. Knowledge management(s). *Journal of Knowledge Management*, 3, 110-120.
- DEPRES, C. & CHAUVEL, D. Year. The Thinking Behind the Action in Knowledge Management. In: European Conference on Knowledge Management, 2001 Bled, Slovenia. 133-152.
- DESANCTIS, G. & POOLE, M. S. 1994. Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science*, 5.
- DICKEY, M. H., BURNETT, G., CHUDOBA, K. M. & KAZMER, M. M. 2007. Do you read me? Perspective Making and Perspective Taking in Chat Communications. *Journal of the Association for Information Systems*, 8, 47-70.
- DOOLIN, B. 1998. Information Technology as disciplinary technology: being critical in interpretive research on information systems. *Journal of Information Technology*, 13, 301-311.
- DORMANN, C. & ZIJLSTRA, F. R. H. 2003. Call centres: High on technology- high on emotions. *European Journal of Work and Organizational Psychology*, 12, 305-310.
- DRUCKER, P. F. 1992. The New Society of Organizations. *Harvard Business Review*, 95-104.
- DRUCKER, P. F. 1993. *Post-Capitalist Society*, Oxford, Butterworth-Heinemann.
- DU-BABCOCK, B. & BABCOCK, R. D. 2007. Genre Patterns in Language Based Communication Zones. *Journal of Business Communication*, 44, 340-373.
- EDWARDS, K., CHISOLM, L. & SMITH, T. 2003. Craving for coaching: A case study from Kwik-Fit Insurance Services. *Journal of Financial Services Marketing*, 8, 167-173.
- ELLINGSEN, G. Year. Knowledge Work in Hospitals. In: IFIP 8.2??, 2002 Barcelona, Spain. 465-484.
- ELLIS, V. & TAYLOR, P. 2006. 'You don't know what youve got till it's gone': re-contextualising the origins, development and impact of the call centre. *New Technology, Work and Employment*, 21, 107-122.
- ELMHOLDT, C. 2004. Knowledge management and the practice of knowledge sharing and learning ar work: a case study. *Studies in Continuing Education*, 26, 327-330.

- ESKEROD, P. & SKRIVER, H. J. 2007. Organizational Culture Retraining In-house Knowledge Transfer Between Project Managers- A Case Study. *Project Management Journal*, 110-122.
- FELDMAN, M. S. 1989. *Order without design*, Stanford, CA, Stanford University Press.
- FERNIE, S. & METCALF, D. 1998. (Not) Hanging on the Telephone: Payments Systems in the New Sweatshops. *Centre for Economic Performance*. London: London School of Economics.
- FESTINGER, L. 1957. *A theory of cognitive dissonance*, Evanston, Illinois, Row & Peterson.
- FETTERMAN, D. M. 1998. *Ethnography*, London, Sage Publications.
- FINNEGAN, D. & WILCOCKS, L. 2006. Knowledge sharing issues in the introduction of a new technology. *Journal of Enterprise Information Management*, 19, 568-590.
- FISHER, K. & FISHER, M. D. 1998. *The Distributed Mind: Achieving High Performance Through the Collective Intelligence of Knowledge Work Teams*, New York, Amacom, American Management Association.
- FITZGERALD, B. & HOWCROFT, D. 1998. Towards dissolution of the IS research debate: from polarization to polarity. *Journal of Information Technology*, 13, 313-326.
- FONDAS, N. & STEWART, R. 1994. Enactment in Managerial Jobs: A Role Analysis. *Journal of Management Studies*, 31, 84-103.
- FRANZ, C. R. & ROBEY, D. 1984. An Investigation of User-Led System Design: Rational and Political Perspectives. *Communications of the ACM*, 27, 1202-1217.
- GADAMAR, H.-G. 1980. Practical Philosophy as a Model for the Human Sciences. *Research in Phenomenology*, 9, 74-85.
- GALLIERS, R. 1995. A Manifesto for Information Management Research. *British Journal of Management*, 6, S45-S52.
- GHOSH, T., YATES, J. & ORLIKOWSKI, W. 2004. Using Communication Norms for Coordination: Evidence from a Distributed Team. *SEFIT working paper*, 1-29.
- GIDDENS, A. 1976. *New Rules of Sociological Method*, Hutchinson, London.
- GIDDENS, A. 1979. *Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis*, Los Angeles, University of California Press.
- GIDDENS, A. 1984. *The Constitution of Society*, Cambridge, Polity Press.
- GIDDENS, A. (ed.) 1990. *Structuration Theory and Sociological Analysis*, London: The Falmer Press.
- GIDDENS, A. & PIERSON, C. 1998. *Conversations with Anthony Giddens: Making Sense of Modernity*, Cambridge, Polity Press.
- GILL, J. & JOHNSON, P. 1991. *Research Methods for Managers*, London, Chapman Publishing Ltd.
- GLAZER, B. G. & STRAUSS, A. L. 1967. *the Discovery of Grounded Theory: Strategies for Qualitative Research*, London, Weidenfeld and Nicholson.
- GOFFMAN, E. 1974. *Frame Analysis*, Oxford, Basil Blackwell.
- GORELICK, C. & APRIL, K. A. 2004. BP case study: KM team structuration and sense making (Part 1). *South African Journal of Business Management*, 35, 1-16.
- GRAUMANN, C. F. 1989. Perspective Setting and Taking in Verbal Interaction. *Language Processing in Social Context*. North-Holland: Elsevier Science Publishers.
- GRAUMANN, M., ARNOLD, H.-J. & BELTJES, M. 2003. Call Centres: A Case Study on the Interplay Between Organization and Information Technology. *The Geneva Papers on Risk and Insurance*, 28, 111-126.

- GRAY, P. H. & DURCIKOVA, A. 2005. The Role of Knowledge Repositories in Technical Support Environments: Speed Versus Learning in User Performance. *Journal of Management Information Systems*, 22, 159-190.
- GROTH, L. 1999. *Future Organizational Design*, Chichester, Wiley.
- GROUP, C. C. 2000. *Call Centre Industry Study* [Online]. Available: <http://www.callcentermagazine.com/article/COM20000906S0012> [Accessed].
- HALES, C. 2007. Structural Contradiction and Sense-Making in the First-Line Manager Role. *Irish Journal of Management*, 147-179.
- HALLIDEN, B. & MONKS, K. 2005. Employee-centred management in a call centre. *Personnel Review*, 34, 370-383.
- HARRIS, C., DANIELS, K. & BRINER, B. B. 2003. A daily diary study of goals and affective well-being at work. *Journal of Occupational and Organizational Psychology*, 76, 401-410.
- HASSARD, J. 1991. Multiple Paradigms and Organizational Analysis: A Case Study. *Organization Studies*, 12, 275-299.
- HAUGAARD, M. 1991. *Structures, Restructuration and Social Power*. Ph.D., Trinity College Dublin.
- HAYES, N. 2001. Boundless and bounded interactions in the knowledge work process: the role of groupware technologies. *Information and Organization*, 11, 79-101.
- HAYES, N. & WALSHAM, G. 2001. Participation in groupware-mediated communities of practice: a socio-political analysis of knowledge working. *Information and Organization*, 11, 263-288.
- HAZLETT, S. A., MCADAM, R. & BEGGS, V. 2008. An exploratory study of knowledge flows: A case study of Public Sector Procurement. *Total Quality Management*, 19, 57-66.
- HEDLUND, G. 1994. A Model of Knowledge Management and the N-Form Corporation. *Strategic Management Journal*, 15, 73-90.
- HELLSTROM, T., KEMLIN, P. & MALMQUIST, U. 2000. Knowledge and competence management at Ericsson: decentralization and organizational fit. *Journal of Knowledge Management*, 4, 99-110.
- HENDRIKS, P. H. J. 1999. Do smarter systems make for smarter organizations? *Decision Support Systems*, 27, 197-211.
- HENDRIKS, P. H. J. & VRIENS, D. J. 1999. Knowledge-based systems and knowledge management: Friends of foes? *Information & Management*, 35, 113-125.
- HENFRIDSSON, O. 2000. Ambiguity in IT adaptation: making sense of First Class in a social work setting. *Information Systems Journal*, 10, 87-104.
- HILMER, S. & HILMER, B. 2004. The Real Costs of Turnover: Lessons from a Call Centre. *Human Resource Planning*.
- HIRSHHEIM, R., KLEIN, H. K. & NEWMAN, M. 1991. Information Systems Development as Social Action: Theoretical Perspective and Practice. *Omega International Journal of Management Science*, 19, 587-608.
- HIRSHHEIM, R. A. 1992. Information Systems Epistemology: An Historical Perspective. In: GALLIERS, R. (ed.) *Information Systems Research: Issues, Methods and Practical Guidelines*. Oxford: Blackwell Scientific Publications.
- HISLOP, D. 2005. *Knowledge Management in Organizations: A Critical Introduction*, Oxford, Oxford University Press.
- HOLDSWORTH, L. & CARTWRIGHT, S. 2003. Empowerment, stress and satisfaction: an exploratory study of a call centre. *Leadership & Organization Development Journal*, 24, 131-140.

- HOLMAN, D., BATT, R. & HOLTGREWE, U. 2007. The Global Call Centre Report: International Perspectives on Management and Employment. www.callcenter.org.
- HOLMAN, D., EPITROPAKI, O. & FERNIE, S. 2001. Understanding learning strategies in the workplace: A factor analytic investigation. *Journal of Occupational and Organizational Psychology*, 74, 675-681.
- HOPKINSON, G. C. 2001. Influence in Marketing Channels: A Sense-Making Investigation. *Psychology & Marketing*, 18, 423-444.
- HOULIHAN, M. 2001. Managing to manage? Stories from the call centre floor. *Journal of European Industrial Training*, 25, 208-220.
- HOWCROFT, D. & WILSON, M. 2003. Participation: 'bounded freedom' or hidden constraints on user involvement. *New Technology, Work and Employment*, 18, 2-19.
- HYMAN, J., BALDRY, C., SCHOLARIOS, D. & BUNZEL, D. 2003. Work-Life Imbalance in Call Centres and Software Development. *British Journal of Industrial Relations*, 41, 215-239.
- IDS 1999. Pay and conditions in call centres. London: IDS.
- IM, H.-G., YATES, J. & ORLIKOWSKI, W. 2004. Temporal Coordination through Genres and Genre Systems. *SEIT working paper*.
- IRANI, Z., EZINGEARD, J.-N., GRIEVE, R. J. & RACE, P. 1999. A case study strategy as part of an information systems research methodology: a critique. *International Journal of Computer Applications in Technology*, 12, 190-198.
- JACKSON, C. Year. Process to Product- Creating Tools for Knowledge Management. In, 1999 Lisbon, Portugal.
- JARVENPAA, S. & STAPLES, D. S. 2000. The use of collaborative electronic media for information sharing: an exploratory study of determinants. *Journal of Strategic Information Systems*, 9, 129-154.
- JENSEN, M. C. & MECKLING, W. H. 1995. Specific and General Knowledge, and Organizational Structure. *Knowledge Management and Organizational Design 1996*. Newton MA: Butterworth-Heinemann.
- JIMES, C. & LUCARDIE, L. 2003. Reconsidering the tacit-explicit distinction- A move toward functional (tacit) knowledge management. *Electronic Journal of Knowledge Management*, 1, 23-32.
- JONES, M. R. & KARSTEN, H. 2008. Giddens's Structuration Theory and Information Systems Research. *MIS Quarterly*, 32, 127-157.
- KAKIHARA, M. & SORENSEN, C. Year. 'Post-Modern' Professionals' Work and Mobile Technology. In: Working Paper 114, June 2002 Department of Information Systems: London School of Economics and Political Science. 1-15.
- KAPLAN, B. & DUCHON, D. 1988. Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly*, 12, 571-586.
- KARSTEN, H. 1995. Converging Paths to Notes: In search of computer-based information systems in a networked company. *Information Technology & People*, 8, 7-34.
- KATSAMAKAS, E. 2007. Knowledge processes and learning options in networks: Evidence from telecommunications. *Human Systems Management*, 26, 181-192.
- KATZ, D. & KAHN, R. L. 1966. *The Social Psychology of Organizations*, New York, Wiley.
- KEYTON, J. 1999. Relational communication in groups. In: FREY, L. R., GOURAN, D. S. & POOLE, M. S. (eds.) *The handbook of group communication theory & research*. Thousand Oaks CA: Sage.

- KILIMINSTER, R. 1991. Structuration theory as a world-view. In: BRYANT, C. G. A. & JARY, D. (eds.) *Giddens' theory of structuration: A critical appreciation*. London: Routledge.
- KINGSTON, J. & MACINTOSH, A. 2000. Knowledge management through multi-perspective modelling: representing and distributing organizational memory. *Knowledge Based Systems*, 13.
- KINNIE, N., HUTCHINSON, S. & PURCELL, J. 2000. 'Fun and surveillance': the paradox of high commitment management in call centres. *International journal of Human Resource Management*, 11, 967-985.
- KIRKMAN, B. L. & ROSEN, B. 1999. Beyond Self Management: Antecedents and consequences of team empowerment. *Academy for Management Journal*, 42, 58-74.
- KLEIN, H. K. & MYERS, M. D. 1999. A Set of Principles for Conducting and Evaluating Interpretative Field Studies in Information systems. *MIS Quarterly*, 23, 67-93.
- KOGUT, B. & ZANDER, U. 1992. Knowledge of the Firm. Combinative Capabilities, and the Replication of Technology. In: PRUSAK, L. (ed.) *Knowledge in Organizations (1997)*. Newtown MA: Butterworth-Heinemann.
- KRAUSS, R. M., FUSSELL, S. R. & CHEN, Y. 1995. Coordination of Perspective in Dialogue: Intrapersonal and Interpersonal Processes. *Mutualities in Dialogue*. Cambridge: Cambridge University Press.
- KRAUSZ, E. & MILLER, S. H. 1974. *Social Research Design*, London, Longman.
- KUBO, I., SAKA, A. & PAN, S. L. 2001. Behind the scenes of knowledge sharing in a Japanese Bank. *Human Resource development International*, 4, 465-485.
- LABERIS, B. 1998. One big pile of knowledge. *Computerworld*.
- LACITY, M. C. & JANSON, M. A. 1994. Understanding Qualitative Data: A Framework of Text Analysis Methods. *Journal of Management Information Systems*, 11, 137-155.
- LAPLANTE, A. 1997. Sharing the Wisdom. *Computerworld*.
- LAYDER, D. 1981. *Structure, Interaction and Social Theory*, London, Routledge and Keegan Paul.
- LAYDER, D. 1987. Key Issues in Structuration Theory: Some Critical Remarks. *Current Perspectives in Social Theory*, 8, 25-46.
- LAZARIC, N., LONGHI, C. & THOMAS, C. 2008. Gatekeepers of Knowledge versus Platforms of Knowledge: From Potential to Realized Absorbative Capacity. *Regional Studies*, 42, 837-852.
- LEE, A. S. 1989. A Scientific Methodology for MIS Case Studies. *MIS Quarterly*, 33-50.
- LEE, A. S. & BASKERVILLE, R. L. 2003. Generalizing Generalizability in Information Systems Research. *Information Systems Research*, 14, 221-243.
- LEE, T. W. & MAURER, S. D. 1997. The retention of knowledge workers with the unfolding model of voluntary transfer. *Human Resource Management Review*, 7, 247-275.
- LEE, Y. W. & STRONG, D. M. 2003. Knowing-Why About Data Processes and Data Quality. *Journal for Management Information Systems*, 20, 13-39.
- LEONARD, D. & SENSIPER, S. 1998. The Role of Tacit Knowledge in Group Innovation. *California Management Review, Special Issue on Knowledge and the Firm*, 40, 112-132.
- LEONARD, D. & SWAP, W. 2004. Deep Smarts. *Harvard Business Review*, 88-97.
- LEUNG, M. & MAO, J.-Y. 2004. Proactive Task support Enabled by a Neural Network: A Prototype for Telephone Triage. *International Journal of Human-Computer Interaction*, 17, 309-332.

- LEVITT, B. & MARCH, J. G. 1988. Organizational Learning. *Annual Review of Sociology*, 14, 319-338.
- LEWIG, K. A. & DOLLARD, M. F. 2003. Emotional dissonance, emotional exhaustion and job satisfaction in call centre workers. *European Journal of Work and Organizational Psychology*, 12, 366-392.
- LIEDTKA, J. M., HASKINS, M. E., ROSENBLUM, J. W. & WEBER, J. 1997. The Generative Cycle: Linking Knowledge and Relationships. *Sloan Management Review*, 47-58.
- LINCOLN, Y. & GUBA, E. 1985. *Naturalistic Inquiry*, Beverly Hills, Sage Publications.
- LIND, M. R. & SULEK, J. M. 2000. A methodology for forecasting knowledge work projects. *Computers & Operational Research*, 27, 1153-1169.
- LINDKVIST, L. 2005. Knowledge Communities and Knowledge Collectivities: A Typology of Knowledge Work in Groups. *Journal of Management Studies*, 42, 1189-1210.
- LOUIS, M. R. 1980. Surprise and Sense Making: What Newcomers Experience in entering Unfamiliar Organizational Settings. *Administrative Science Quarterly*, 25, 226-251.
- LOWENDAHL, B. R. & HAANES, K. 1997. The Unit of Activity: A New Way to Understand Competence Building and Leveraging. In: HEENE, S. R. A. (ed.) *Strategic Learning and Knowledge Management*. New York: John Wiley & Sons Ltd.
- LUO, L., LIU, J., SHAO, L., LU, W. & YE, M. 2006. A context-aware smart-call-centre solution: Improving customer service for online games. *IBM Systems Journal*, 45, 145-160.
- LYYTINEN, K. J. & NGWENYAMA, O. K. 1992. What does computer support for cooperative work mean? A structural analysis of computer supported cooperative work. *Accounting, Management and Information Technologies*, 2, 19-37.
- MAANEN, J. V. & SCHEIN, E. 1979. Towards a theory of organizational socialization. In: STRAW, B. M. (ed.) *Research in Organizational Behaviour*. Greenwich CT: JAI Press.
- MACINTOSH, N. B. & SCAPENS, R. W. 1991. Management Accounting and Control Systems: A Structuration Theory Analysis. *Journal of Management Accounting Research*, 3, 131-159.
- MANNINEN, A. 1995. The experience of knowledge in everyday accounting: a study of Finnish accounting managers. *The European Accounting Review*, 4, 455-483.
- MANTOVANI, G. & SPAGNOLLI, A. 2001. Legitimizing technologies: Ambiguity as a premise for negotiation in a networked institution. *Information Technology & People*, 4, 304-320.
- MARKUS, M. L. 2001. Toward a Theory of Knowledge Reuse: Types of Knowledge Reuse Situations and Factors in Reuse Success. *Journal of Management Information Systems*, 18, 57-93.
- MARKUS, M. L. & LEE, A. S. 1999. Special Issue on Intensive Research in Information Systems: Using Qualitative, Interpretative, and Case Methods to Study Information Technology- Foreword. *MIS Quarterly*, 23, 35-38.
- MARTENSSON, M. 2000. A critical review of knowledge management as a management tool. *Journal of Knowledge Management*, 4, 204-216.
- MASSEY, A. P. & CLAPPER, D. L. 1995. Element Finding: The Impact of a Group Support System on a Crucial Phase of Sense Making. *Journal of Management Information Systems*, 11, 149-176.

- MATUSIK, S. F. & HILL, C. W. L. 1998. The Utilization of Contingent Work, Knowledge Creation, and Competitive Advantage. *Academy of Management Review*, 23, 680-697.
- MCELROY, M. Year. The Knowledge Lifecycle. In: ICM conference on Knowledge Management, April 1999 Miami, Florida.
- MCLUREWASCO, M. & FARAJ, S. 2000. 'It is what one does': why people participate and help others in electronic communities of practice. *Journal of Strategic Information Systems*, 9, 155-173.
- MENGUC, B., HAN, S.-L. & AUH, S. 2007. A test of a model of new salespeople's socialization and adjustment in a collectivist culture. *Journal of Personal Selling and Sales Management*, XXXVII, 149-167.
- MEYERS, M. H. & ZACK, M. H. 1996. The Design and Development of Information Products. *Sloan Management Review*, 43-59.
- MEZHER, T., ABDUL-MALAK, M. A., GHOSN, I. & AJAM, M. 2005. Knowledge Management in Mechanical and Industrial Engineering Consulting: A Case Study. *Journal of Management In Engineering*, 21, 138-147.
- MILES, M. B. & HUBERMAN, A. M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook*, London, Sage Publications.
- MINAMI, C. 2009. The role of call centres for manufacturers. *The Marketing Review*, 9, 115-126.
- MINTZBERG, H. 1988. the Coming of the New Organisation. *Harvard Business Review*, 45-53.
- MONTEALERGE, R. 1997. The interplay of information technology and the social milieu. *Information Technology & People*, 10, 106-131.
- MORGESON, F. P. 2005. The External Leadership of Self-Managing Teams: Intervening in the Context of Novel and Disruptive Events. *Journal of Applied Psychology*, 90, 497-508.
- MURPHY, A. G. 2001. The Flight Attendant Dilemma: An Analysis of Communication and Sensemaking During In-Flight Emergencies. *Journal of Applied Communication Research*, 29, 30-53.
- MURRAY, S. R. & PEYREFITTE, J. 2007. Knowledge Type and Communication Media Choice in Knowledge Transfer Process. *Journal of Managerial Issues*, XIX, 111-133.
- NANDHAKUMAR, J. & JONES, M. 2001. Accounting for time: managing time in project-based teamworking. *Accounting, Organizations and Society*, 26, 193-214.
- NELSON, R. & WINTER, S. 1982. *An Evolutionary Theory of Economic Change*, Cambridge MA, Harvard University Press.
- NERNEY, C. 1997. Getting to know knowledge management. *Network World*.
- NEWELL, S., ROBERTSON, M., SCARBROUGH, H. & SWAN, J. 2002. *Managing Knowledge Work*, Basingstoke, Palgrave Macmillan.
- NEWELL, S., SCARBROUGH, H. & SWAN, J. 2001. From Global Knowledge Management to Internal Electronic Fences: Contradictory Outcomes of Intranet Development. *British Journal of Management*, 12, 97-111.
- NONAKA, I. 1991. The Knowledge-Creating Company. *Harvard Business Review*, November-December, 96-104.
- NONAKA, I. & TAKEUCHI, H. 1995. *The Knowledge-Creating Company*, New York, Oxford University Press.
- O'REILLY, C. 1982. Variations in decision makers use of information sources: the impact of quality and accessibility of information. *Academy of Management Journal*, 25, 756-771.

- OLSEN, K. & MYERS, M. D. 1999. Trying to improve communication and collaboration with information technology: An action research project which failed. *Information Technology & People*, 12, 317-332.
- ORLIKOWSKI, W. & BARLEY, S. R. 2001. Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other? *MIS Quarterly*, 25, 145-165.
- ORLIKOWSKI, W., YATES, J., OKAMURA, K. & FUJIMOTO, M. 1995a. Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use. *Organization Science*, 6, 423-444.
- ORLIKOWSKI, W. J. 1992. The duality of technology: rethinking the concept of technology in organizations. *Organization Science*, 3, 398-427.
- ORLIKOWSKI, W. J. 1993. CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *MIS Quarterly*, 309-340.
- ORLIKOWSKI, W. J. 1996. Improvising Organizational Transformation Over Time: A Situated Change Perspective. *Information Systems Research*, 7, 63-92.
- ORLIKOWSKI, W. J. 2000. Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science*, 11, 404-428.
- ORLIKOWSKI, W. J. 2002a. *Knowing in Practice: Enacting a Collective Capability in Distributed Organizing* [Online]. opensource.mit.edu/papers/orlikowski.pdf. Available: opensource.mit.edu/papers/orlikowski.pdf [Accessed 20 March 2003].
- ORLIKOWSKI, W. J. 2002b. *Knowing in Practice: Enacting a Collective Capability in Distributed Organizing*. *Organization Science*, 13, 249-273.
- ORLIKOWSKI, W. J. & BAROUDI, J. J. 1991. Studying Information Technology in Organizations: Research Approaches & Assumptions. *Information Systems Research*, 2, 1-28.
- ORLIKOWSKI, W. J. & GASH, D. C. 1994. Technological Frames: Making Sense of Information Technology in Organizations. *ACM Transactions on Information Systems*, 12, 174-207.
- ORLIKOWSKI, W. J. & ROBEY, D. 1991. Information Technology and the Structuring of Organizations. *Information Systems Research*, 2, 143-167.
- ORLIKOWSKI, W. J. & YATES, J. 1994. Genre Repertoire: Examining the Structuring of Communicative Practices in Organizations. *Administrative Science Quarterly*, 39, 541-574.
- ORLIKOWSKI, W. J., YATES, J., OKAMURA, K. & FUJIMOTO, M. 1995b. Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use. *Organization Science*, 6, 423-444.
- OSTRO, N. 1997. The corporate brain. *Chief Executive*.
- OUTHWAITE, W. 1990a. Agency and Structure. In: CLARK, J. C., CELIA, M. & SOHAN, M. (eds.) *Anthony Giddens: Consensus and Controversy*. London: The Falmer Press.
- OUTHWAITE, W. 1990b. Interchange: Outhwaite replies to Archer. In: CLARK, J. C., CELIA, M. & SOHAN, M. (eds.) *Anthony Giddens: Consensus and Controversary*. London: The Falmer Press.
- PAWLOWSKI, S. D. & ROBEY, D. 2004. Bridging User Organizations: Knowledge Brokering and the Work of Information Technology Professionals. *MIS Quarterly*, 28, 645-672.
- PERTEMPS 1999. Retaining your best agents. London: Pertemps Recruitment Partnership.

- PFEFFER, J. & SUTTON, R. I. 2000. *The Knowing-Doing Gap: How Smart Companies Turn Knowledge into Action*, Boston, Harvard Business School Press.
- PITZ, G. F., HEERBOOTH, J. & SACHS, N. J. 1980. Procedures for eliciting choices in analysis of individual decisions. *Organizational Behaviour and Human Performance*, 26, 396-408.
- POLANYI, M. 1958. *Personal Knowledge. Towards a Post-Critical Philosophy*, Chicago, The University of Chicago Press.
- POLLARD, D. 2005. The Future of Knowledge. *Across the Board*, 54-56.
- POZZEBON, M. & PINSONNEAULT, A. Year. The Structuration theory in IS: Usage Patterns and Methodological Issues. *In: Academy of Management Proceedings*, 2000 Toronto, Canada.
- QUINN, J. B., ANDERSON, P. & FINKELSTEIN, S. 1996. Managing Professional Intellect: Making the Most of the Best. *Harvard Business Review*, 71-80.
- RIEGE, A. & O'KEEFFE, M. 2007. Intra-Organisational Knowledge Drivers in the INPD Process: The Case of Wattyl Limited. *Journal of International Innovation Management*, 11, 349-378.
- RILEY, P. 1983. A structuralist account of political cultures. *Administrative Science Quarterly*, 28, 414-437.
- ROBERTS, J. 2000. From know-how to show-how: the role of information and communication technologies in the transfer of knowledge. *Technology Analysis & Strategic Management*, 12, 429-443.
- ROBERTS, J. 2006. Limits to Communities of Practice. *Journal of Management Studies*, 43, 623-639.
- ROBERTSON, M., SORENSEN, C. & SWAN, J. 2001. Survival of the leanest: intensive knowledge work and groupware adaptation. *Information Technology & People*, 14, 334-352.
- ROBEY, D. 1996. Research Commentary: Diversity in Information Systems Research: Threat, Promise, and Responsibility. *Information systems Research*, 7, 400-408.
- ROOS, J., ROOS, G., EDVINSSON, L. & DRAGONETTI, N. C. 1997. *Intellectual Capital: Navigating in the new business landscape*, London, Macmillan Press Ltd.
- ROSA, J. A. 2001. Embodied-Concept Use in Sense Making by Marketing Managers. *Psychology & Marketing*, 18, 445-474.
- RYLE, G. 1949. *The Concept of Mind*, Chicago, University of Chicago Press.
- SAMIOTIS, K. & POULYMENAKOU, A. Year. Using a Practice-Based Perspective to Inform the Design of Knowledge Management Systems: Evidence from Supporting (E)-Banking Activities [Case Study]. *In: European Conference on Information Systems*, 2002 Gdansk Poland. 805-816.
- SANCHEZ, R. 1997. Managing Articulated Knowledge in Competence-based Competition. *In: SANCHEZ, R. & HEENE, A. (eds.) Strategic Learning and Knowledge Management*. New York: John Wiley & Sons Ltd.
- SANDBERG, J. 2000. Understanding Human Competence at work: An Interpretive Approach. *Academy of Management Journal*, 43, 9-25.
- SCARBOROUGH, H. 1999. Knowledge as work: Conflicts in the Management of Knowledge Workers. *Technology & Strategic Management*, 11, 5-16.
- SCHON, D. A. 1983. *The Reflective Practitioner*, New York, Basic Books.
- SCHULTZ, U. Year. Investigating the Contradictions in Knowledge Management. *In: IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes*, 1998 Helsinki, Finland. Omnipress, Wisconsin, USA, 155+.

- SCHULTZ, U. 2000. A Confessional Account of an Ethnography About Knowledge Work. *MIS Quarterly*, 24, 3-41.
- SCHULTZ, U. & ORLIKOWSKI, W. J. 2004. A Practice Perspective on Technology-Mediated Network Relations: The Use of Internet-Based Self-Serve Technologies. *Information Systems Research*, 15, 87-106.
- SCHULTZE, U. Year. Investigating the Contradictions in Knowledge Management. In: LARSEN, T. J., LEVINE, L. & DEGROSS, J. I., eds. *Information Systems: Current Issues and Future Challenges: Proceedings of the IFIP 8.2 and 8.6 Joint Working Conference on Information Systems, December 1998 Helsinki*. Omnipress, Wisconsin, USA, 155-174.
- SEELY-BROWN, J. & DUGUID, P. 1991. Organizational Learning and Communities-of-practice: Toward a Unified View of Working, Learning and Innovating. *Organization Science*, 2, 40-57.
- SEELY-BROWN, J. & DUGUID, P. 1998. Organizing Knowledge. *California Management Review, Special Issue on Knowledge and the Firm*, 40, 90-111.
- SEELY-BROWN, J. & DUGUID, P. 2001. Knowledge and Organization: A Social-Practice Perspective. *Organization Science*, 12, 198-213.
- SERAFEIMIDIS, V. & SMITHSON, S. 2000. Information systems evaluation in practice: a case study of organizational change. *Journal of Information Technology*, 15, 93-105.
- SEWELL, G. & WILKINSON, B. 1992. Someone to watch over me: surveillance, discipline and the JIT labor process. *Sociology*, 26, 271-289.
- SEWELL, W. H. 1992. A Theory of Structure: Duality, Agency, and Transformation. *American Journal of Sociology*, 98, 1-29.
- SHANNON, C. & WEAVER, W. 1949a. *The Mathematical Theory of Communication*, Chicago IL, University of Illinois Press.
- SHANNON, C. E. & WEAVER, W. 1949b. *A Mathematical Theory of Communication*, Urbana, University of Illinois Press.
- SHEN, H. & HUANG, J. Z. 2005. Analysis of call centre arrival data using singular value decomposition. *Applied Stochastic Models in Business and Industry*, 21, 251-263.
- SILVERMAN, D. 2000. *Doing Qualitative Research: A Practical Handbook*, London, Sage Publications.
- SIMON, H. A. 1960. *The New Science of Management*, New York, Harper & Row.
- SOO, C., DEVINNEY, T., MIDGLEY, D. & DEERING, A. Knowledge Management: Philosophy, Processes, and Pitfalls. *California Management Review*, 44, 129-150.
- SORENSEN, C. & KAKIHARA, M. Year. Knowledge Discourses and Interaction Technology. In: Working Paper 115, June 2002. Department of Information Systems: London School of Economics and Political Science, 1-15.
- SPENDER, J.-C. 1996. Making Knowledge the Basis of a Dynamic Theory of the Firm. *Strategic Management Journal (Winter Special Issue)*, 17, 45-62.
- SPENDER, J.-C. & GRANT, R. M. 1996. Knowledge and the Firm: Overview. *Strategic Management Journal (Winter Special Issue)*, 17, 5-9.
- STANKEVICIUTE, J. Year. Different Epistemological Perspectives and their Implications for Knowledge Management in Organizations. In: European Conference on Knowledge Management, 2001 Bled, Slovenia. 631-646.
- STRAUSS, A. & CORBIN, J. 1990. *Basics of qualitative research: Grounded theory procedures and techniques*, Newbury Park CA, Sage.
- STRAUSS, A. & CORBIN, J. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, London, Sage Publishing Ltd.

- SVEIBY, K. E. 1997. *The New Organizational Wealth: Managing & Measuring Knowledge-Based Assets*, San Francisco, Berrett-Koehler Publishers Inc.
- TALLMAN, S., JENKINS, M., HENRY, N. & PINCH, S. 2004. Knowledge, Clusters, and Competitive Advantage. *Academy for Management Review*, 29, 258-271.
- TAYLOR, P. & BAIN, P. 1999. 'An assembly line in the head': work and employee relations in the call centre. *Industrial Relations Journal*, 30, 101-117.
- THOMPSON 1989.
- THOMPSON, M. P. A. 2004. Confessions of an IS Consultant or the Limitations of Structuration Theory. *Judge Institute of Management: Research Papers in Management Studies*, WP01/2004, 1-36.
- TISSEN, R., ANDRIESSEN, D. & LEKANNE-DEPREZ, F. 2000. *The Knowledge Dividend*, London, Financial Times- Prentice Hall.
- TIWANA, A. & RAMESH, B. 2001. A design knowledge management system to support collaborative information product evolution. *Decision Support Systems*, 31, 241-262.
- TRAUTH, E. M. & JESSUP, L. M. 2000. Understanding Computer Mediated Discussions: Positivist and Interpretive Analyses of Group Support System Use. *MIS Quarterly*, 24, 43-79.
- TSOUKAS, H. 1996. The Firm as a Distributed Knowledge System: A Constructionist Approach. *Strategic Management Journal (Winter Special Issue)*, 17, 11-25.
- TURNER, J. W. & TINSLEY, C. Year. Polychronic communication: managing multiple conversations at once. In: Annual meeting of the Academy of Management,, 2002 Denver CO.
- TYNDALE, P. Year. The Organisational Knowledge Development Life Cycle: From Knowledge Creation to Knowledge Application. In: European Conference on Knowledge Management, 2001 Bled, Slovenia. 663-676.
- TYRE, M. J. & ORLIKOWSKI, W. J. 1993. Exploiting Opportunities for Technological Improvement in Organizations. *Sloan Management Review*, 13-26.
- TYRE, M. J. & ORLIKOWSKI, W. J. 1994. Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations. *Organization Science*, 5, 98-118.
- VAAST, E. & WALSHAM, G. 2005. Representations and actions: the transformation of work practices with IT use. *Information & Organization*, 15, 65-89.
- VENTERS, W., CUSHMAN, M. & CORNFORD, T. Year. Creating Knowledge for Sustainability: Using SSM for Describing Knowledge Environments and Conceptualising Technological Interventions. In: Working Paper 107, March 2002 Department of Information Systems: London School of Economics and Political Science.
- VENTERS, W., CUSHMAN, M. & CORNFORD, T. 2005. Knowledge About Sustainability: SSM as a Method for Conceptualising the UK Construction Industry's Knowledge Environment. *Journal of Computing and Information Technology*, 13, 137-148.
- VOLKEMA, R. J. 1983. Problem formulation in planning and design. *Management Science*, 29, 639-652.
- VOLKEMA, R. J. 1988. Problem complexity and the formulation process in planning and design. *Behavioural Science*, 33, 292-300.
- VONHIPPLE, E. 1988. *The Sources of Innovation*, Cambridge, MIT Press.
- WALSHAM, G. 1995. Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4, 74-81.
- WALSHAM, G. 2001a. Cross Cultural Studies and Structuration. *Judge Institute of Management: Research Papers in Management Studies*.

- WALSHAM, G. 2001b. Globalization and ICTs: Working Across Cultures. *Research Papers in Management Studies: Judge Institute of Management Studies*, WP 8/2001.
- WALSHAM, G. 2002. Cross-Cultural Software Production and Use: A Structural Analysis. *MIS Quarterly*, 26, 359-380.
- WALSHAM, G. & WAEMA, T. 1994. Information systems Strategy and Implementation: A Case Study of a Building Society. *ACM Transactions on Information Systems*, 12, 150-173.
- WALTERS, R., JASELSKIS, E. J. & KURTENBACH, J. M. 2007. Classification of Knowledge within the Electrical Contracting Industry: A Case Study. *Leadership and Management in Engineering*, 11-17.
- WATSON-MANHEIM, M. B. & BELANGER, F. 2007. Communication Media Repertoires: Dealing with the Multiplicity of Media Choices. *MIS Quarterly*, 31, 267-293.
- WEICK, K. E. 1979. *The social psychology of organizing*, New York, Random House.
- WEICK, K. E. 1985. Cosmos vs. Chaos: Sense and Nonsense in Electronic Contexts. *Organizational Dynamics*, 51-64.
- WEICK, K. E. 1995. *Sensemaking in Organizations*, London, Sage Publications.
- WIIG, K. 1993. *Knowledge Management Foundations*, Arlington, TX, Schema Press.
- WIIG, K. M. 1999. What future knowledge management users may expect. *Journal of Knowledge Management*, 3, 155-165.
- WIIG, K. M., DEHOOG, R. & VANDERSPEK, R. 1997. Supporting Knowledge Management: A Selection of Methods and Techniques. *Expert Systems with Applications*, 13, 15-27.
- WIKSTROM, A.-C. & LARRSON, U. S. 2003. Patient on display- a study of everyday practice in intensive care. *Journal of Advanced Nursing*, 43, 376-383.
- WOERNER, S. L., ORLIKOWSKI, W. J. & YATES, J. 2004. The Media Toolbox: Combining Media in Organizational Communication. *SEIT Working Paper #13954*, 1-36.
- YATES, J. & ORLIKOWSKI, W. 2002. Genre Systems: Structuring Interaction through Communicative Norms. *The Journal of Business Communication*, 39, 13-35.
- YATES, J. & ORLIKOWSKI, W. J. 1992. Genres of Organizational Communication: A Structural Approach to Studying Communication and Media. *Academy of Management Review*, 17, 299-326.
- YATES, J. & ORLIKOWSKI, W. J. 2007. The PowerPoint Presentation and its Corollaries: How Genres Shape Communicative Action in Organizations. In: ZACHERY, M. & THRALLS, C. (eds.) *The Cultural Turn: Communicative Practices in Workplaces and the Professions*. Amityville, NY: Baywood Publishing.
- YATES, J., ORLIKOWSKI, W. J. & OKAMURA, K. 1999. Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction. *Organization Science*, 10, 83-103.
- YATES, J., ORLIKOWSKI, W. J. & WOERNER, S. L. Year. Virtual Organizing: Using Threads to Coordinate Distributed Work. In: Hawaii International Conference on System Sciences, January 6-9 2003 Big Island Hawaii.
- YIN, R. K. 1994. *Case Study Research: Design and Methods*, London, Sage Publications Inc.
- ZACHRY, M. 2000. Conceptualizing Communication Practices in Organizations: Genre-based Research in Professional Communication. *Business Communication Quarterly*, 63, 95-101.

- ZACK, M. H. 1999a. Developing a Knowledge Management Strategy. *California Management Review*, 41, 125-145.
- ZACK, M. H. 1999b. Managing Codified Knowledge. *Sloan Management Review*, 45-57.
- ZOHAR, E., MANDELBAUM, A. & SHIMKIN, N. 2002. Adaptive Behaviour of Impatient Customers in Tele-Queues: Theory and Empirical Support. *Management Science*, 48, 566-583.